من ذكريات العمل (16)

مشروع قناطر اسنا الجديدة

سد الأغلاق (Closure Dam)

التغيير من التصميم الأصلي الى الحل البديل

(Alternative Solution for Closure Dam)

مقدمة

يُعد مشروع قناطر إسنا الجديدة من المشروعات الهامة التي نفذتها وزارة الموارد المائية والري ضمن سلسلة المشروعات الضخمة لإحلال وتجديد القناطر الكبرى على نهر النيل. وقد تَلَت هذا المشروعَ مشروعاتٌ أخرى تشمل قناطر نجع حمادي الجديدة، وقناطر أسيوط الجديدة، ثم مجموعة قناطر ديروط الجديدة؛ بهدف تحسين وتطوير المنظومة المائية في جميع أنحاء البلاد.

تم تنفيذ قناطر إسنا الجديدة في الفترة من أبريل 1989 إلى عام 1994. ويُعتبر سد الإغلاق جزءًا رئيسيًا من منشآت المشروع التي تضم أيضًا منشآت خرسانية أخرى مثل محطة الكهرباء والمفيض والهويس الملاحي. ويُكمل السد إغلاق الجزء الأكبر من النهر بطريقة اقتصادية من الجانب الأيمن (في الجزء العميق من النهر) الذي كان يُستخدم للملاحة أثناء فترة التنفيذ، مما يبرز أهميته في نجاح المشروع بأكمله.

بعض البيانات عن سد الإغلاق:

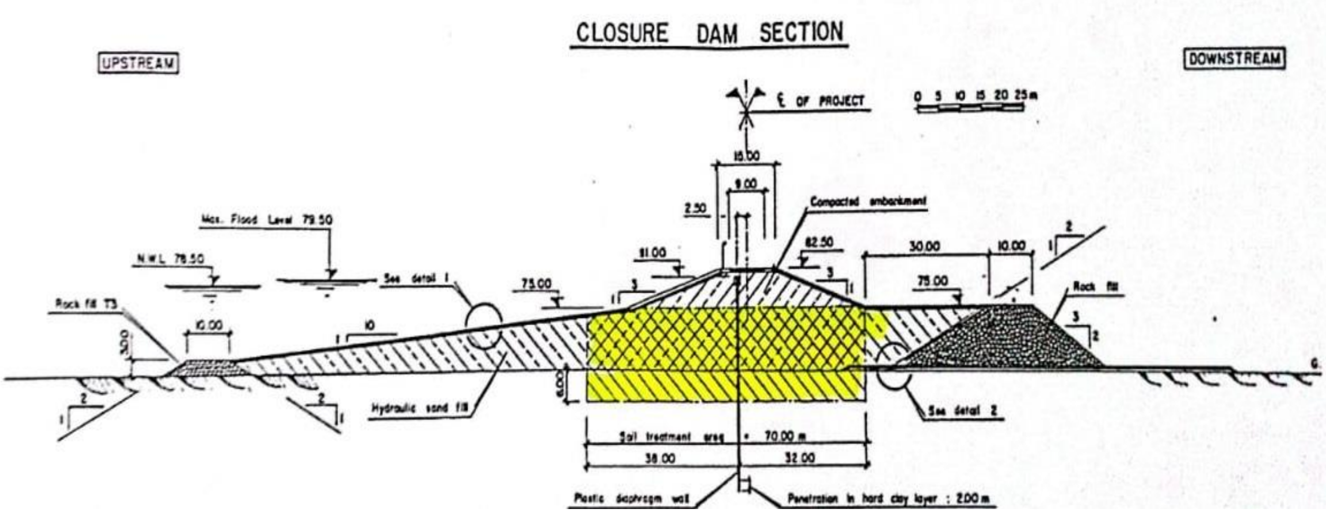
- يبلغ طول السد الدائم 520 مترًا
- يصل عرضه عند القاع إلى 220 مترًا
- عند القمة (عند منسوب 82.5 متر) يكون العرض 15 مترًا
- يتكون من سد ركامي مُنفذ على طبقات متتابعة من المواد الرملية والتربة الزلطية، مع دكة حماية حجرية من الخارج
- يتوسط السد ستارة بلاستيكية تمتد حتى الطبقة غير المنفذة
- إجمالي حجم السد 675 ألف متر مكعب

أثناء مرحلة التنفيذ، تم إجراء بعض التعديلات على التصميمات الأصلية وفقًا لمتطلبات وظروف العمل، وكان من أبرز هذه التعديلات التغيير الاستراتيجي في تصميم سد الإغلاق (Closure Dam).

<u>التصميم الأصلي في العقد:(Tender Design)</u>

1. سد حجري خلفي يمتد من القاع حتى منسوب (75.00 متر) بعرض 10 أمتار عند القمة وبميل جانبي 3:2، مكون من أحجار النوع B (100-200 مم).
2. سد حجري أمامي بارتفاع 3 أمتار وعرض 10 أمتار وبميل جانبي 2:1، مكون من أحجار النوع T3 (0-152 مم).
3. ملء المسافة بين المنسوب العلوي للسدين الأمامي والخلفي بالرمال الناتجة من أعمال الحفر بالتكريك، مع عمل ميل من منسوب (75.00 متر) إلى منسوب السد الأمامي بمقدار 1:10.
4. دك التربة المحيطة بمحور الستارة بعرض 70 مترًا (38 مترًا من اليسار و32 مترًا من اليمين) بطريقة التعويم الاهتزازي(Vibroflotation) ، وهي إحدى طرق الدك بالاهتزاز لتحسين خصائص التربة.
5. ردم جسم السد فوق منسوب (75.00 متر) حتى منسوب (82.50 متر) باستخدام تربة مستوردة من خارج الموقع مع الدك الجيد، بعرض 15 مترًا من الأعلى وبميل جانبي 3:1.
6. تنفيذ ستارة قاطعة دائمة من الخرسانة البلاستيكية (Permanent Diaphragm Wall)في محور السد، تمتد حتى تصل إلى الطبقة الطينية الصماء لمسافة 2 متر، وترتفع حتى منسوب (80.50 متر) من الأعلى.

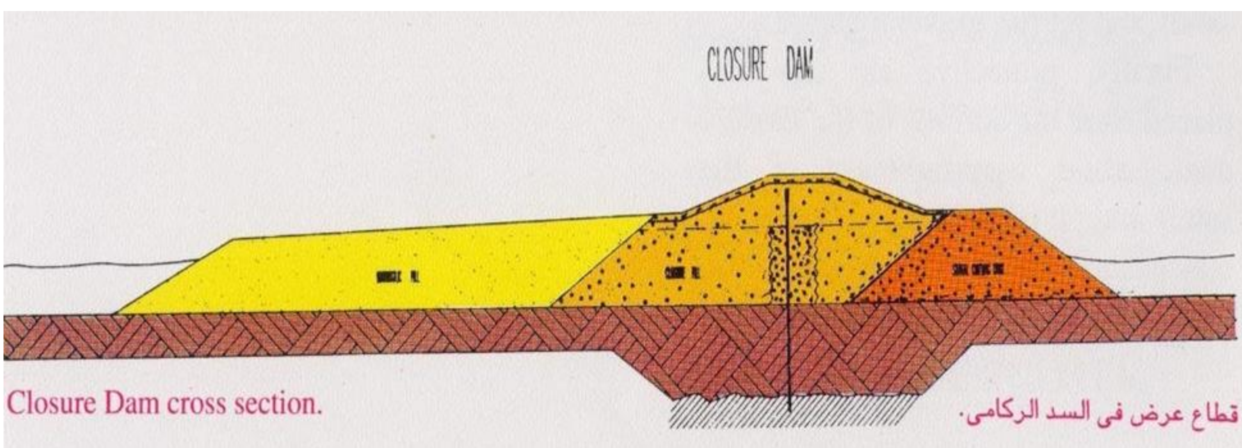
مرفق رقم (1)
التصميم الاصلى فى العقد



التصميم المعدل:(Alternative Solution for Closure Dam)

1. السد الحجري الخلفي: تم الحفاظ على القطاع تقريبًا مع تغيير نوع الأحجار من (100-200 مم) إلى (50-100 مم)، وتغيير نسيج الجيوتكستايل من وزن 320 إلى 1200 جم/م² للجزء السفلي، و800 جم/م² للميل الأمامي.
2. استبدال الرمل الناتج من الحفر في تكوين جسم السد بتربة زلطية من محجر الدير (مكونة من رمل وزلط بأحجام أقل من 100 مم)، حيث ينتهي الردم عند مسافة حوالي 35 مترًا من محور الطريق عند منسوب (75.00 متر)، ثم يستمر بالانحدار الطبيعي حتى القاع.
3. إكمال الردم الأمامي باستخدام الرمل الناتج من عمليات الحفر بزاوية ميل 1:40 كما هو موضح في المقطع العرضي.
4. تكوين جسم الطريق فوق منسوب (73.00 متر) كما هو وارد في العقد باستخدام تربة مستوردة مع الدك الجيد.
5. تنفيذ نواة (core) في جسم السد حول الستارة القاطعة بعرض 10 أمتار (5 أمتار من كل جانب) باستخدام تربة مكونة من رمل وزلط (أقل من 100 مم) مع إضافة 10% من المواد الناعمة (أقل من 5 مم)، مع حقن هذه النواة بالبنتونايت قبل تنفيذ الستارة. وتُعرف هذه العملية باسم Vibrogrouting.

كما موضح بالقطاع المرفق



Closure Dam cross section.

قطاع عرض فى السد الركامى.

أعمال الحقن في السد الدائم:

تم تنفيذ أعمال الحقن في السد الدائم على جانبي الستارة الدائمة في المنطقة الواقعة داخل النهر، لضمان عدم حدوث انهيارات أثناء الحفر في المنطقة بين سطح الماء والقاع، حيث لا يمكن دك هذه المنطقة تحت الماء. ويبلغ متوسط عمق الحقن حوالي 12 مترًا، مع الحفر إلى أسفل القاع لمسافة 2 متر على الأقل. شملت

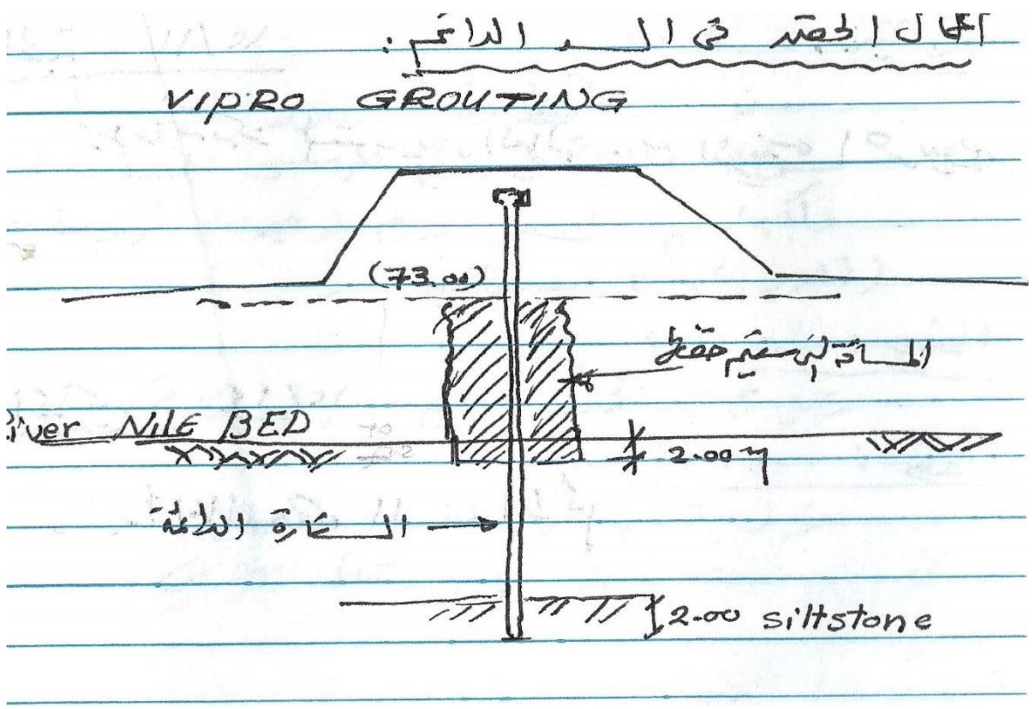
أعمال الحقن مسافة حوالي 200 متر عند منسوب أقل من (66.00 متر)، حيث تم تنفيذ نقاط الحقن على مسافة 90 سم على جانبي محور الستارة وعلى مسافات 6 أمتار، مع التبادل بين الجانبين.

مرفق رقم (12)

مكونات خلطة الحقن:

- 931كجم ماء
- 37كجم بنتونيت
- 180كجم أسمنت

كما هو موضح بالرسم المرفق



<u>أسباب التغيير:</u>

1. الاســـتغناء عن الردم بالرمل الناتج من الحفر بالتكريك في المنطقة المطلوب دكها بطريقة التعويم الاهتزازي (Vibroflotation)، حيث أظهرت الدراســـات أن رمال النيل في هذه المنطقة

تحتوي على نســـبة عالية من المواد الناعمة (Fines) تتجاوز 12% وفقًا للمواصـــفة القياســـية (ASTM Sieve No. 200).

2. مع هذه النسبة المرتفعة من النعومة، تصبح نتائج الدك بالاهتزاز غير فعالة وغير مضمونة، كما أن معالجة هذه المشكلة تتطلب تكاليف باهظة ومددًا زمنية طويلة للتنفيذ.

3. يُعد الردم بالتربة الزلطية من محجر الدير أكثر ضـــمانًا من الناحية الفنية، حيث تتميز هذه المواد بكونها أكثر خشونة، مما يقلل الاعتماد على التقنيات المعقدة مثل الدك بالاهتزاز، كما أنها أقل تكلفةً وتستغرق وقتًا أقصر في التنفيذ.

تغييــر التصـــميم فـــي أي مشـــروع إنشـــائي يكـــون أمـــر معقـــدا، وممكـــن يكـــون لـــه أبعـــاد فنيـــة وتعاقديـــة...ولأن هـــذه التغييـــر يعتبـــر تغييـــرا أساســـيا فـــي جـــزء رئيســـي مـــن منشـــآت المشـــروع بمـــا يكتنفـــه مـــن مشـــاكل فنيـــة وتعاقديـــة فقـــد اســـتلزم العديـــد مـــن الاجتماعـــات والمقـــابلات مـــع الخبـــراء والاستشـــاريين استمر أكثـــر مـــن عـــام للوصـــول الـــى قناعـــة مشـــتركة بهـــذا المقتـــرح البـــديل بمشـــاركة كل الأطراف من المالك والاستشاري والمقاول انه هو الحل المقبول.

<u>التسلسل التاريخى للمقترح البديل</u>

<u>1990-10-20</u>

أرســـل المقـــاول خطابـــا الـــى الاستشـــاري يفيـــد بأنـــه قـــام بتعيـــين "مســـتر ســـامبانيللى" استشـــاري لهـــا وانـــه ضـــمن الموضـــوعات التـــي ســـيقوم بدراســـتها هـــو ســـد الاغـــلاق (Closer Dam) بالتعـــاون مـــع المكتـــب الاستشـــاري المصـــمم للمشـــروع (ELC). وانـــه فـــي رأى المقـــاول انـــه يوجـــد اقتـــراح مســـاوى مـــن الناحيـــة الفنيـــة وربمـــا أكثـــر أمانـــا مـــن تصـــميم العقـــد وربمـــا يحقـــق وفـــرا فـــي التكـــاليف. مرفق رقم (2)

<u>1990-10-29</u>

رد الاستشـــاري بأنـــه إذا كـــان التصـــميم الجديـــد مســـاويا لتصـــميم العقـــد فنيـــا وأكثـــر منـــه امنـــا فانـــه يمكـــن اعتبـــاره طالمـــا كـــان اقـــل فـــي التكـــاليف ومـــدة التنفيـــذ وان ايـــة أبحـــاث جديـــدة او دراســـات تؤكـــد هـــذا المقتـــرح ســـتكون علـــى جانـــب المقـــاول وعلـــه الســـير فـــي التصـــميمين بـــالتوازي حتـــى يمكـــن حســـم الاختيـــار مـــع الإحاطـــة بانـــه فـــي كـــل الأحـــوال لـــن يترتـــب عليـــه ايـــه أعبـــاء ماليـــة إضـــافية او أي زيادة في الوقت ويجب ان يقدم ما يبرره فنيا وماليا مرفق رقم (3)

<u>يوليو 1991</u>

قـــدم المقـــاول تقريـــره الخـــاص بالتصـــميم البـــديل (Closer Dam Acceptance Report) كما هو موضح سابقا مرفق (رقم4)

1991-9-17

تـم عقـد اجتمـاع فـي جامعـة القـاهرة بـين مستشـارى الـوزارة المتخصصـين بمـا فـيهم (المكتـب الاستشـاري سـوجريا واديبكـو) مستشـارى المالـك والمقـاول ومستشـاريه وكـان الهـدف الرئيسـي مناقشـة مـدى ملاءمـة تفاصـيل انشـاء سـد الإغـلاق وفقًـا لقتـرح المقـاول الصـادر فـي يوليـو 1991، مع التركيز على التعديلات المقترحة على التصميم الأصلي

فـى هـذا الاجتمـاع قـدم الدكتورسـامبانيللى (Sembenell) (ممثـل المقـاول) التعـديلات التاليـة على التصميم الأساسي:(Tender Design)

1- اسـتبدال الرمـل المضـغوط بـالاهتزاز (vibroflotation) فـي المنطقـة المركزيـة للسـد بمـواد طبيعيـة مـن منطقـة الـدير المجـاورة للمشـروع ، مـع تنقيتهـا مـن الحبيبـات الكبيـرة (أكبـر من 100 مم).

2-اسـتخدام صـخور طبيعيـة بحجـم 50-100 مـم لبنـاء سـد القـاطع النهـري Stream) (Cutting Dike، مع تجنب الصخور المطحونة والمكسورة.

3-إضـافة 10% مـن المـواد الناعمـة (المـارة مـن منخـل 5 مـم) لتحسـين التماسـك فـي المنطقة المركزية.

4-زيـادة سـماكة نسـيج الجيوتكسـتايل (geotextile) تحـت السـد وعلـى الميـل العلـوي إلى 1200 جم/م² أو 800 جم/م²

وقـد أشـار منـدوب المكتـب الاستشـاري الفرنسـي سـوجريا (SOGREAH) إلـى أن التصـميم الأصـلي كـان يعتمـد علـى بيانـات التربـة المتاحـة وقتهـا، ولـم تكـن هنـاك أدلـة علـى عـدم جـدواه ووافـق على أن اقتراح المقاول قد يكون حلًا عمليًا، لكنه طلب:

- إجراء اختبارات إضافية على الرمل النهري.
- تقديم حسابات تفصيلية لاستقرار السد تحت تأثير الزلازل.
- إضافة طبقة حماية من الحصى الطبيعي فوق الرمل.

وطلب المكتب الاستشاري المحلى أديبكو (EDIPDO)

- طلب أخذ 50 عينة إضافية من الرمل النهري لتقييم مدى ملاءمته للاستخدام.
- أكد على ضرورة مناقشة التكلفة والجدول الزمني للبديل المقترح.

وتـم الاتفـاق علـى عقـد اجتمـاع آخـر خـلال شـهر لمراجعـة النتـائج واتخـاذ القـرار النهـائي.

مرفق رقم (5)

<u>1991-10-19</u>

قدم المقاول تكاليف تنفيذ التصميم البديل وفيه يؤكد على سلامة الحل البديل من وجهة نظره الفنية بالإضافة الى تقليل التكلفة وانه لا يتحمل مسئولية تنفيذ التصميم الوارد بالعقد مرفق رقم (7)

<u>1991-11-4</u>

في جامعة القاهرة اجتماع ثانى بين أطراف العمل المالك والاستشارى والمقاول ومستشاريهم وقد تم خلال هذا الاجتماع مناقشات عميقة الخاصة بالنواحي الفنية والتعاقدية وانه طبقا للبيانات المتاحة حاليا عن طبيعة التربة فان الحل الوارد بالعقد يعتبر صالحا للتنفيذ ولكن قد تحدث مشاكل منه اثناء التنفيذ بطريقة ال (Vibrofloatation) للرمل الخارج من التكريك وان الحل البديل المقترح من المقاول يبدو انه مقبول فنيا ويلزم بعض الاختبارات مطلوب استيفاؤها وفى نفس الوقت ان الموافقة على الحل البديل سيكون بعد الاتفاق على التكاليف كما ان المقاول ليس له الحق بالمطالبة بتعويضات عن التصميم

مرفق رقم (6)

<u>1991-12-16 الى 1992-11-19</u>

أجتماعات بين المالك والاستشارى والمقاول وعلى اثر ذلك ارسل الاستشاري خطابا الى المقاول موضحا به الاتي :

أ. تقييم الحل الأصلي والحل البديل

- الحل الأصلي:(Tender Solution)
  - تم تقييمه في اجتماع بجامعة القاهرة (4 نوفمبر 1991) على أنه لا يزال مجديًا من الناحية الفنية.
  - ومع ذلك، هناك تحديات محتملة أثناء تنفيذ عملية الاهتزاز الهيدروليكي (Vibroflotation)للدمك الهيدروليكي، مما دفع المقاول لاقتراح حل بديل.
- <u>الحل البديل :(Contractor’s Alternative Solution)</u>
  - تم تقييمه على أنه مقبول فنيا ، ولكن يتطلب بعض الفحوصات الإضافية للتصميم.
  - المقاول قدم تكاليف هذا الحل في رسالته بتاريخ 19 أكتوبر 1991

ب. نتائج الفحوصات في الموقع

- بنـاءً علـى طلـب المهنـدس المقـيم، تـم إجـراء 8 حفـر استكشـافية(Boreholes) ، وأظهـرت النتـائج أن نسـبة المـواد الناعمـة (Fines) فـي الرمـل أقـل مـن 12%، ممـا يـدعم إمكانيـة تنفيـذ كلا الحلين (الأصلي والبديل).

يتـرك الخطـاب حريـة اختيـار الحـل للمقـاول، نظـرًا لمسـؤوليته عـن التصـميم والتنفيـذ وفقًـا لشروط العقد.

ج. الشروط المالية لقبول الحل البديل

- البنود المقبولة :
  - معظـم بنـود سـد الإغـلاق الـواردة فـي القائمـة الأخيـرة التـي قـدمها المقـاول (16 ديسمبر 1991) تم قبولها، باستثناء بعض العناصر.
  - الأسعار المقبولة مؤقتًا تشمل :
    - الجيوتكستايل غير المنسوج (1200 جم و800 جم)
    - الحفر والحقن(Grout Filling)
    - طريقـة الأنشـاء المعدلـة لـلستارة الدائمـة (Remnant Diaphragm Wall) P.D.W. بشـرط موافقـة استشـاري EDIPCO علـى تغييـر أبعـاد الألـواح ال Panels مـن 7.5 متـر إلـى 3 متـر مـع تداخل (overlapping) 0.75 متر.
- البنود المرفوضة :
  - تكلفة الاختبارات المعملية في إيطاليا (26,118 دولار) :
  - رسوم الاستشارات الإضافية (110,000 دولار):
  - تعويض المقاول الفرعي للاهتزاز الهيدروليكي (1.7 مليون دولار) :
- التكلفة النهائية للحل البديل :
  - بعد استبعاد البنود المرفوضة، تم تحديد التكلفة الإجمالية بـ :
    - 6.445346مليون جنيه مصري.
    - 4.195470مليون دولار أمريكى
- طلب التأكيد :
  - طُلـب مـن المقـاول تأكيـد اختيـاره للتصـميم (الأصـلي أو البـديل) بشـكل عاجـل، وفـي حال اختيار الحل البديل، تأكيد قبوله للأسعار والكميات المذكورة.

    نقطة هامة

    كـان أصـرار المالـك والاستشـارى علـى ضـرورة موافقـة المقـاول علـى اعتبـار ان كـلا الحلـين صـالحين وقـابلين للتنفيـذ بـالرغم مـن اقتنـاع الجميـع ان الحـل البـديل هـو

الأفضل وذلك لاعتبارات تعاقدية هامة اذ لو اعتبر ان حل العقد غير قابلا للتنفيذ كانت ستعطى المقاول الفرصة للتقدم بمطالبات تعاقدية كبيرة. مرفق رقم (8)

1991-12-17

خطاب من المقاول يؤكد انه سيقوم بتنفيذ الحل البديل المقترح منه مرفق رقم (9)

1992-1-15

خطاب من الاستشاري للمالك يوضح فيه ان الحل البديل أكفأ فنيا وان على المالك ان يسرع في اصدار امر التغيير للمقاول لسرعة البدء في التنفيذ مرفق رقم (10)

1992-1-20

خطاب من الأستاذ الدكتور عبد الفتاح أبو العيد الاستشاري المتخصص من قبل استشاري المالك (اديبكو) وفيه يؤكد على ان المشكلة الفنية الرئيسية هي نوعية الرمال الموجودة في الموقع تحتوي على نسبة عالية من المواد الناعمة(fines) ، مما يجعلها غير مناسبة للدمك بالاهتزاز .(Vibroflotation) وان التجارب السابقة أظهرت أن هذه المواد تؤثر سلبًا على كفاءة الدمك، وقد تؤدي إلى صعوبة تحقيق الكثافة المطلوبة وتعطى نتائج غير مؤكدة في الاختبارات الميدانية مما قد يؤدى الى تأخيرات في التنفيذ وفى النهاية هو يؤيد الحل البديل وذلك بالاتفاق مع المكتب الاستشاري الفرنسي (سوجريه). مرفق رقم (11)

خاتمة:

تم اصدار الامر التغيير رقم 15(Variation order No.15) وتم تنفيذ الاعمال بنجاح كبير طبقا للحل البديل وبلغت التكلفة النهائية كالاتى:

تكلفة العقد 6,445,346 جنيه مصري بالإضافة إلى 4,195,470 دولار أمريكي

التكلفة الختامية للحل البديل كما تم تنفيذه فعليًا 7,559,143 جنيه مصري بالإضافة إلى 5,016,729 دولار أمريكي

تم استرداد الفرق الزائد البالغ 1,113,797 جنيه مصري و821,259 دولار أمريكي

- **التصميم الأصلي** :محفوف بمخاطر فنية، مالية (تكاليف غير محددة)، وزمنية (تأخيرات) كبيرة بسبب اعتماد على تقنية غير مضمونة مع رمل غير مناسب.
- **التصميم المعدل** :يقدم حلاً أكثر أمانًا واقتصادية، مع مخاطر محدودة (تعاقدية ولوجستية) يمكن إدارتها.

اختيار التصميم المعدل كان قرارًا منطقيًا مدعومًا بالبيانات الفنية، حيث وازن بين الأمان، التكلفة، والجدول الزمني، مع تقليل المخاطر الكبيرة المرتبطة بالتصميم الأصلي.

ويُعد التعامل مع هذه المشكلة نموذجًا جيدا في إدارة المشروعات الكبرى، حيث عكس مستوى عاليًا من الكفاءة الفنية والتعاقدية، إلى جانب الجهد الكبير المبذول من جميع الأطراف، والحرص على المصلحة العامة للمشروع. وقد تميز هذا التعامل بالأمانة والثقة في اتخاذ القرار، مما ساهم في الوصول إلى حل متوازن من الناحية الفنية والتعاقدية والاقتصادية، يضمن سلامة التنفيذ ويخدم أهداف المشروع على المدى الطويل

اردت التذكير بهذا العمل الهام فكأن القدر شاء لي أن أكون شاهدًا على نهاية فصل هام من فصول هذا العمل اثناء التنفيذ وأشارك فيه ليس فقط كمُهندس، بل ككاتب يسجل ذاكرة المكان بتغيير وتعديل مكون رئيسى من سد الاغلاق بطريقة فنية وتعاقدية ناجحة .

وهنا يجب ان نذكر بالخير كل من ساهم في تنفيذ هذا المشروع ونترحم على من انتقلوا الى جوار ربهم وعلى رأسهم:

المرحوم المهندس عبد الحميد الصادق المهندس المقيم للمشروع

المرحوم المهندس محمد عبد المجيد عثمان رئيس فريق الاستشاري للمشروع (اديبكو)

الذين كانت لهم الأيادي البيضاء في نجاح المشروع.

اللهم اجمعنا بهم فى مستقر رحمته، واجعل كل تعبهم في ميزان حسناتهم، واجعل ذِكرهم الطيب صدقة جارية على أرواحهم

شكرا جزيلا لكل من السيد المهندس مجدى عباس رئيس الادارة المركزيه والمهندس المقيم السابق لمشروع قماطر اسيوط الجديده السابق.

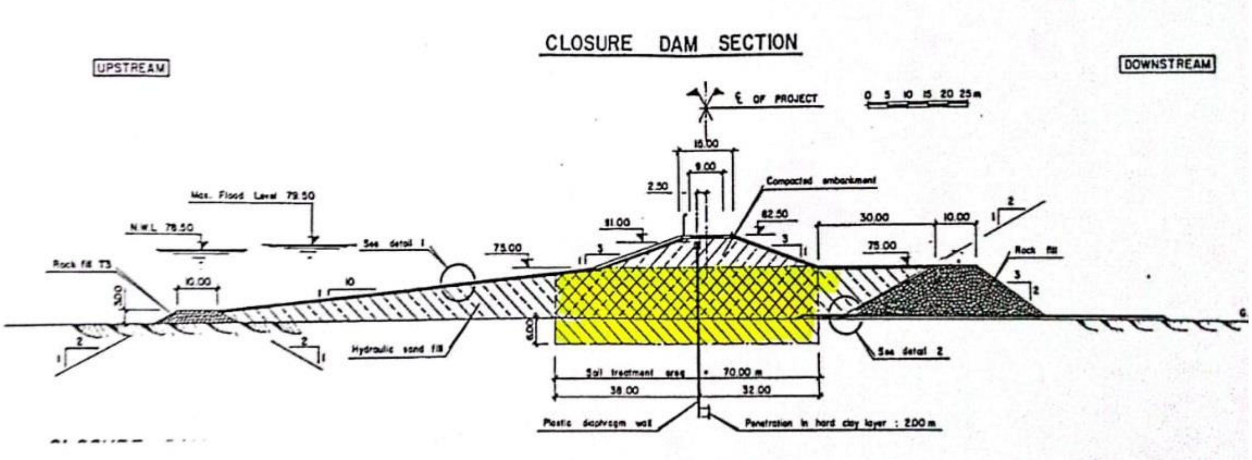
السيد المهندس محمود عبد الحميد رئيس الادارة المركزيه بهيئة السد العالى

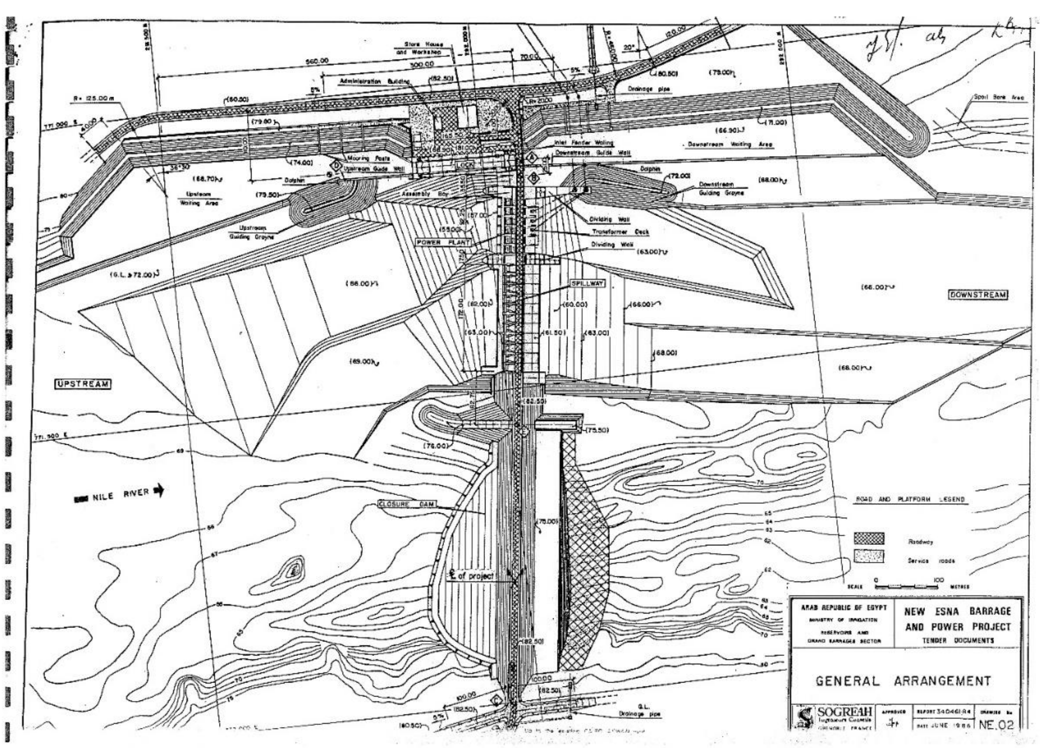
السيد المهندس عز الدين محمود طلب رئيس الادارة المركزيه والمهندس المقيم لمشروع مجموعة قناطر ديروط الجديده.

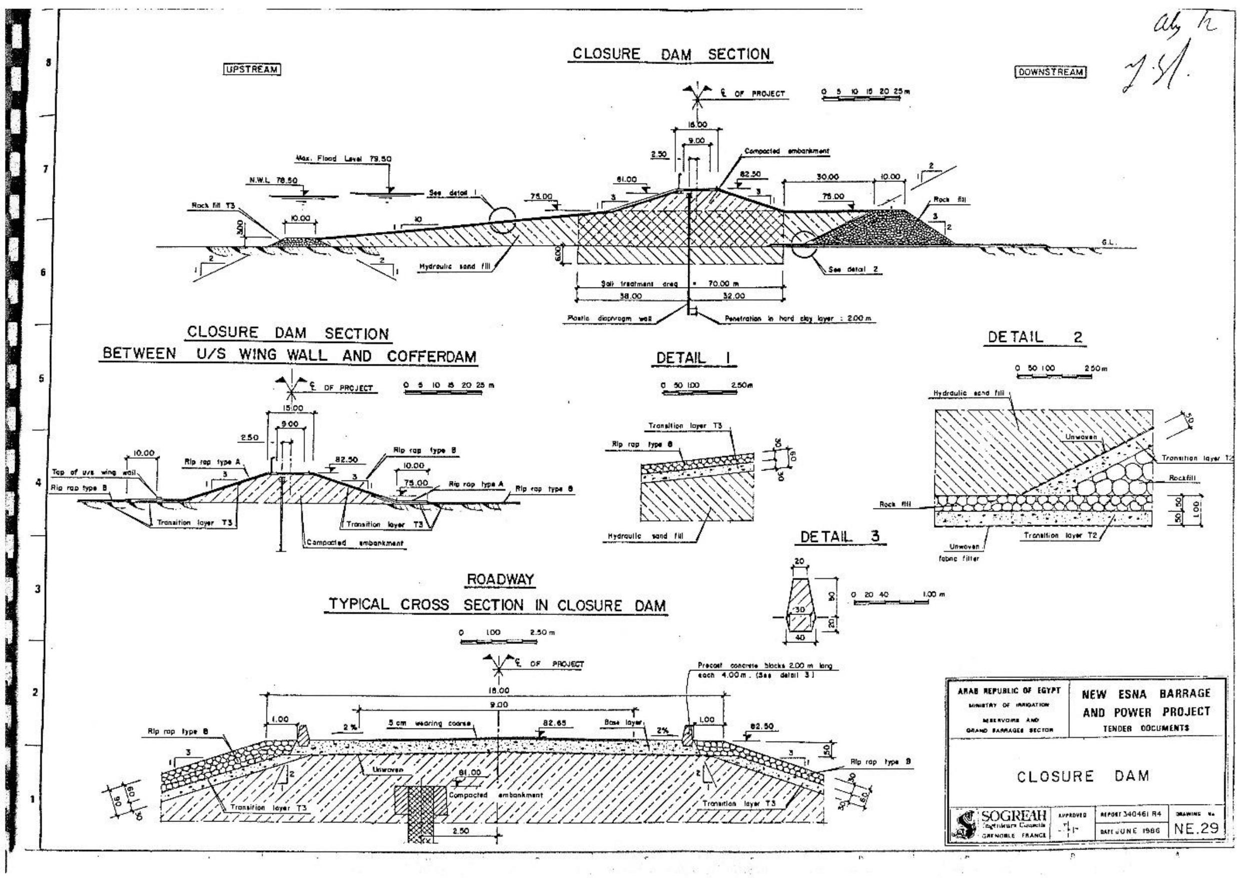
على قيامهم بالمراجعة والتصحيح جزاهم الله كل خير.

مرفق بعض الصور والرسومات اثناء التنفيذ واثناء غلق السد

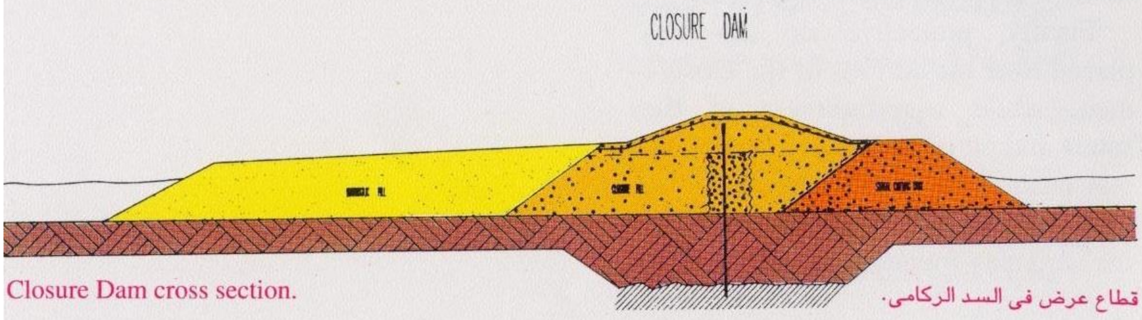
مرفق رقم (13)


CLOSURE DAM SECTION
UPSTREAM
DOWNSTREAM
℄ OF PROJECT
Compacted embankment
Max. Flood Level 79.50
N.W.L. 78.50
See detail 1
Rock fill T5
Hydraulic sand fill
Rock fill
See detail 2
Soil treatment area = 70.00 m
38.00
32.00
Plastic diaphragm wall
Penetration in hard clay layer : 2.00 m


UPSTREAM
DOWNSTREAM
NILE RIVER
CLOSURE DAM
SPILLWAY
POWER PLANT
ARAB REPUBLIC OF EGYPT
MINISTRY OF IRRIGATION
RESERVOIRS AND GRAND BARRAGES SECTOR
NEW ESNA BARRAGE AND POWER PROJECT
TENDER DOCUMENTS
GENERAL ARRANGEMENT
SOGREAH
NE.02


CLOSURE DAM SECTION
UPSTREAM
DOWNSTREAM
CLOSURE DAM SECTION
BETWEEN U/S WING WALL AND COFFERDAM
DETAIL 1
DETAIL 2
DETAIL 3
ROADWAY
TYPICAL CROSS SECTION IN CLOSURE DAM
ARAB REPUBLIC OF EGYPT
NEW ESNA BARRAGE
AND POWER PROJECT
TENDER DOCUMENTS
CLOSURE DAM
SOGREAH
DATE JUNE 1986
NE.29


D.S.DYKE

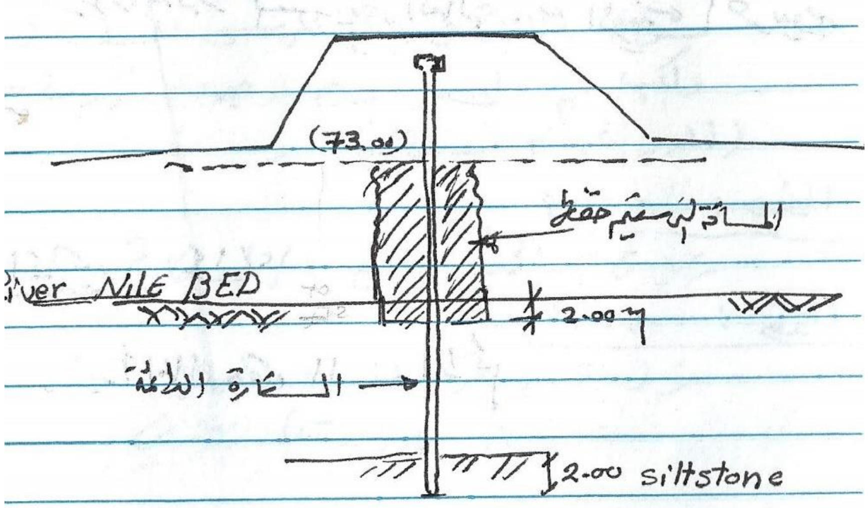


Closure Dam cross section.

قطاع عرض فى السد الركامى.

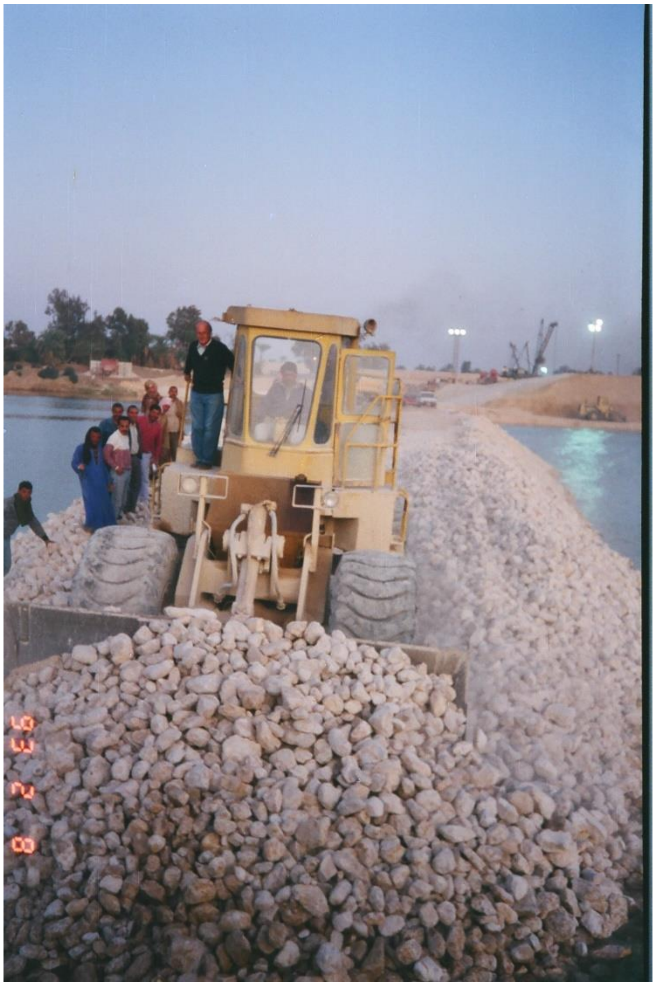
أعمال الحقن في السد الدائم:

VIPRO GROUTING

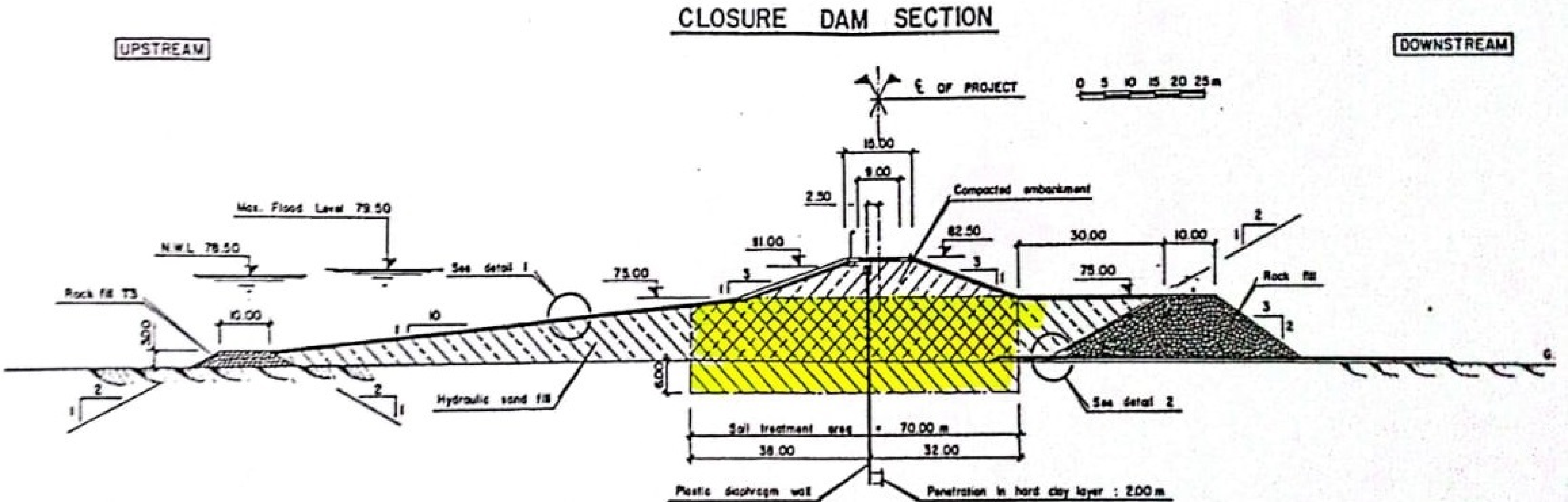



93 2 8


93 2 8



مرفق رقم (1)
التصميم الاصلى فى العقد



EUROCEB

EUROPEAN CONSORTIUM FOR ESNA BARRAGE

Impresit - Girola - Lodigiani

"IMPREGILO" S.P.A.

COGEFAR Costruzioni Generali S.P.A

Gruppo Industrie Elettromeccaniche per

Impianti all'Estero - G.I.E - S.P.A.

ROMENERGO State Enterprise for Foreign Trade

ESNA 20/10/1990
OUR REF. ED/E/679/90

مرفق رقم (٢).

MESSRS
EDIPCO - CAIRO

SUBJECT : CLOSURE DAM
ALTERNATIVE DESIGN

Dear Sirs,

With your letter reference ED/E/581/90 dated 29/09/90 you have been informed that we have retained the services of Mr. Piero Sembenelli, Consulting Engineer, to assist the Joint Venture in design matters.

One of the items that Mr. Sembenelli has addressed and will follow up in the future, in collaboration with ELC, is the design of the Closure Dam. As foreseen in the Technical Specification clause 5.8.1 the tender solution has been duly considered and also possible alternatives have been examined in the light of all information provided by the tender documents as well as of the additional data and experience gained during the early part of the construction activities.

It is our opinion that a proposal, technically equivalent or safer than the Tender solution and offering economic advantages in terms of cost savings to the Employer could be arrived at.

Investigations, studies and preliminary design are in progress and we shall duly advise you further. In the meanwhile we shall appreciate, and are actually asking for, your availability to follow up and examine the investigations, testing, studies and the possible alternative proposal.

Yours Faithfully

EUROCEB
European Consortium For Esna Barrage

Eng. PIER LUIGI CALDANI
Project Manager

c.c. M.O.I. CAIRO: 2 COPIES
c.c. M.O.I. ESNA : 2 COPIES
→ c.c. EDIPCO ESNA : 1 COPY

المكتب الإستشاري للتصميمات الهندسية و مشروعات الري
إديبكو
ENGINEERING DESIGN & IRRIGATION PROJECTS CONSULTING OFFICE - EDIPCO CAIRO, EGYPT

Date: 29/10/90
Ref.: ED/C/146/90
مرفق رقم (٣) :

TO: EUROCEB

Subject: Closure Dam
Alternative Design

Dear sirs,

Refering to your letter ED/E/679/90 dated 20/10/90 recieved on 23/10/90 conserning the a.m. subject.

We consider according to the technical specifications of the T.D., clause 5.8.1, that alternatives can be proposed by the contractor are relating to the construction steps and not for alternative design.

However we find that a new design, technically equivalent & safer than contract solution can be considered taking into consideration that any proposed design shall be at least more economic and working schedule shorter than contract design. Any extra investigation or studies shall be on your side.

You are advised that contract design programe related to closure dam shall be followed & your proposal can be progressing in parallel.

(ع)

SHORE RPOTECTION AUTHORITY BUILDING-FOM EL ESMAILIA SHOUBRA EL MEZALAT
TEL: 2208854 TELEX: 20904 EDPCO FAX: 2208854
مبنى هيئة حماية الشواطىء بجوار فم ترعة الاسماعيلية شبرا المظلات
ت : ٢٢٠٨٨٥٤ فاكس : ٢٢٠٨٨٥٤ تلكس : ٢٠٩٠٤ إديبكو

بسم الله الرحمن الرحيم

المكتب الإستشاري للتصميمات الهندسية ومشروعات الري

إديبكو

ENGINEERING DESIGN & IRRIGATION PROJECTS CONSULTING OFFICE - EDIPCO CAIRO, EGYPT

Our acceptance or refusal of any proposal shall not be reimburced both finantialy or extension of time.

Any proposal submitted has to be supported technicaly and finantialy for consideration.

Best wishs.

Yours faithfully
Chairman EDIPCO
Ezz Awadalla
Eng.EZZ ELDIN AWADALLA

* صورة مرسله للسيد المهندس/ الاستشارى المقيم لمشروع قناطر اسنا

* " " " " / المدير العام نائب المهندس المقيم لمشروع قناطر اسنا

* " " " " / وكيل أول الوزارة والمهندس المقيم لمشروع قناطر اسنا

SHORE RPOTECTION AUTHORITY BUILDING-FOM EL ESMAILIA SHOUBRA EL MEZALAT
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ت: ٢٢٠٨٨٥٤ فاكس: ٢٢٠٨٨٥٤ تلكس: ٢٠٩٠٤ إديبكو

ED/IE/492/91
13.07.91

arab republic of egypt
ministry of irrigation
reservoirs and grand barrages sector

new esna barrage and power project

closure dam acceptance report

july 1991

elc electroconsult milan italy

TABLE OF CONTENTS

INTRODUCTION

This document titled "Closure Dam Acceptance Report" furnishes the results of the review of the tender design of the closure dam for the New Esna Barrage. The report is also intended to suggest all those minor modifications which can improve the technical design and eliminate the possible inconvenience which may be faced during the actual construction of the closure dam.

The report has been prepared with the technical assistance of Mr. Piero Sembenelli, special dam adviser for Euroceb, who during the meeting held in Cairo in May 1991, briefed personally Dr. Abouleid on the content of this document.

1 OBJECT AND SCOPE

The Ministry of Public Works and Water Resources of Egypt entrusted in January 1989 EUROCEB, a joint venture of IMPREGILO COGEFAR G.I.E., with the construction of the works for the New Esna Barrage on the Nile river.

The New Esna Barrage consists of a concrete section, housing a navigation lock, a powerhouse and a spillway and of an embankment section which is to be built at the time of the river closure. The concrete section starts on the left bank and covers nearly half of the river width while the embankment will dam the right and deepest half of the river channel.

The tender documents indicate, for the closure dam, a cross section divided in 3 zones: a rockfill toe downstream, forming a free draining zone, a denser centre zone made of river sand placed as hydraulic fill and densified by vibroflotation, an upstream apron and a downstream wedge against the rockfill toe made with the same material, and placed as hydraulic fill without any densification treatment. A plastic concrete diaphragm cut-off is foreseen in the centre of the structure.

The Tender Design report at chapter 3.2.3 states that '... The results (of the geotechnical investigations) are far from attaining the normal standards required at this stage of the design...' and that '...an adjustment to the project will have to be performed to take into account the findings of the tests for the foundation conditions. '(SOGREAH, 1986).

At the inset of construction activities the Euroceb performed a series of complementary investigations both on foundation soils and on potential sources of construction materials whose findings are compiled in the ELC document ESN-D-8506 "Closure Dam Characteristics of Foundation Soils and Construction Materials"

Object of this report is the Closure Dam for the New Esna Barrage. More in detail, construction and foundation materials will be discussed and cross section and details of the embankment will be described.

Scope of this Report is to review the tender design of the closure dam in the light of the elements collected through additional investigations and the works executed up to date in order to produce which may a safe, viable and optimized design consistent with the materials availability the actual site conditions and a tight construction schedule.

2 MAIN CHARACTERISTICS OF THE DREDGED SAND

2.1 Dredging Works

During the concreting of the structures within the temporary cofferdam, the Euroceb started dredging operations according to the tender design and to the agreed modifications suggested by the hydraulic model tests.

Dredging was started on the downstream tailrace channel. About 100 000 m^3 of material were dredged and disposed of in the left bank spoil area, before the end of September 1990.

2.2 Gradings

Gradings were carried out on 57 split spoon samples. The fine content (passing ASTM n° 200 sieve) was found to be less than 10% on 18 samples (45%) and between 10% and 15% on 3 samples (6%). About 50% of the samples would not fulfill the requirement set by the Technical Specifications under para 5.3.5.2a for sandy materials. The distribution of the fines within each profile is quite random.

Foundation profiles relevant to the dredged area did not show levels or lenses suitable for selective excavation. Dredging was carried out with conventional production techniques based on a systematic indentment of a particular level by the swinging cutter wheel. There is no way of controlling the soil sucked by the dredger and, in practical terms, a given level can only be accepted in its totality or discarded. The conveyance pipeline is several hundreds of metres long and 0.8 m in diameter. Its outlet portion is provided with an energy dissipating flap and must be set on a sand pad. Displacing the pipeline end and resetting the outlet is a time consuming work and the pipeline outlet is moved only periodically. The likelihood that pockets of fines may develop at the fringes of the fill mound exists and may be reduced, to fulfil para 5.3.2.2.d) of the Technical Specifications, only with frequent moves of the pipeline's outlet (TARSHANSKY, 1968).

2.3 Relative Density

The relative densities obtained using Marcuson's correlation (MARCUSON, 1977), with the envelope of minimum

Standard Penetration Tests blow count N relevant to 11 boreholes performed in the hydraulic sandfill of the spoil area, over a depth of about 5 m, resulted in values of Dr = 36 to 46 %. A check of the above results made through the dry unit weights determined by surface, thin wall sampling, suggests relative densities below Dr = 55 %. The above relative densities fall within the limits obtained at several sites and normally expected to be Dr 40 - 50 % (WHITMAN, 1968). Such range of relative density corresponds to a dry unit weight of approximately γ = 16.5 kN/m3. The dredged sandfill, as placed, would not satisfy the requirements set forth by the Technical Specifications under para 11.3 (SOGREAH, 1989).

Hence a densification treatment of the dredged sandfill would be necessary. Treatment should be defined after a trial test according to para 11.7.2 of the Technical Specifications. However one thing must be pointed out in this respect: the required trial test can only be done after filling a substantial portion of the closure dam as stated in para 11.7.2.2.

2.4 Geometry

Visual inspection and topographic survey of the hydraulic fill deposited in the spoil area show that the dredged river sand takes a slope in the order of 1V/40H above tailwater. Below tailwater level, the sandfill front takes a much steeper slope (about 1V/1.6H) which is close to its friction angle for loose conditions $\phi' = 32°$.

The mechanism of growth of a hydraulic fill is complex and depends on many variables like: sand grading, sand production rate, mixture flow rate, the sand concentration and the position of the tail water. The slope extends through a series of alternate sedimentation on the upper part of the dam and of flow slides at the forefront causing a decrease of the slope of the fill (MASTBERGEN et al., 1988). In these premises, it may be difficult to build the 1V / 10H slope indicated in the Tender Drawings below el. 75 and the flow slides may result in loose pockets within the mass.

3 POSSIBILITIES AND EXPECTED EFFECTS OF VIBROFLOTATION

3.1 Vibroflotation of the Hydraulic Fill

The grading of the Upper Sand to be used for the hydraulic fill is at the lower limit of the range of suitability for vibrocompaction. As a matter of fact, the minimum desirable size for conventional vibroflotation is D60 = 0.25 mm while the Upper Esna sand has D60 = 0.15 to 0.40 mm. The fine content of the sand, often exceeding the 15% mark, would greatly reduce the effectiveness of vibroflotation. Experience has shown that the efficiency of this method can be seriously impaired if the soil contains excessive fines (MITCHELL, 1968).

Vibroreplacement with the formation of compacted sand and gravel columns may result the only practicable improvement process. This will, however, result in a markedly disuniform fill, in terms of density (BASORE 1968), as well as permeability. Current practice, as a matter of fact, suggests use of vibroflotation on clean sands.

The achievement of an average relative density Dr = 75 % would produce a fill with an average dry unit weight in the order of γ = 17 kN/m3. Its coefficient of permeability would not be less than k = 6 10^-5 m/s as shown in Fig. 4/2.

The stability of the slope originating at the edge of the working platform under the pore pressure field induced by an extensive and continued application of the vibroflotation process, should be assessed. As a matter of fact, nearly all cases reported in the literature refer to level ground and/or confined fill. This was for example, the case of Aswan High Dam where dune sand containing less than 5% silt fines and processed sand were used in vibrocompacted zones 15 m thick, confined by rockfill dikes on both sides (HASSOUNA 1970; WAFA 1970).

3.2 Vibroflotation of the Foundation Sand

The vibroflotation of the top 6 m of the foundation sand will essentially affect the Upper Sand only. Vibroflotation of a natural sand deposit may destroy

its structure and lower its initial strength for a substantial period of time after treatment completed (MITCHELL 1984). The curves given by Durante and Voronkevich reproduced in Fig. 3/1 may be used to appreciate the amount of strength lost as a consequence of disturbance to a natural, aged deposit.

At Jebba dam in Nigeria where a 25 m thick foundation of medium to coarse sand having a D60 = 0.5 to 3.0 mm (2 to 15 times larger than the corresponding for Esna sands), was compacted with vibroflotation. There was practically no increase in penetration resistance 9 days after treatment as shown in Fig. 3/2. A drop in penetration resistance in some zones, as a result of vibrocompaction, is also reported at Aswan High Dam (DUDLER 1968 in MITCHELL 1984).

Existing clean sand deposits can exhibit a sensitivity such that disturbance can cause a significant reduction in penetration resistance. Also, penetration resistance of freshly densified sands may be less than that of the undisturbed sand prior to densification (MITCHELL 1984).

A reduction, even temporary, in the strength of the natural sand foundation taking place under the freshly filled closure dam, may lead to local instability or to excessive deformations involving the whole structure. Such a possibility advises against following the provisions of para 11.7.2.2 of the Technical Specifications.

A test of proper dimensions, done at a convenient location, outside the embankment of the closure dam and before embarking on its construction, seems therefore compulsory prior to considering the application of vibroflotation to the Upper Sand foundation.

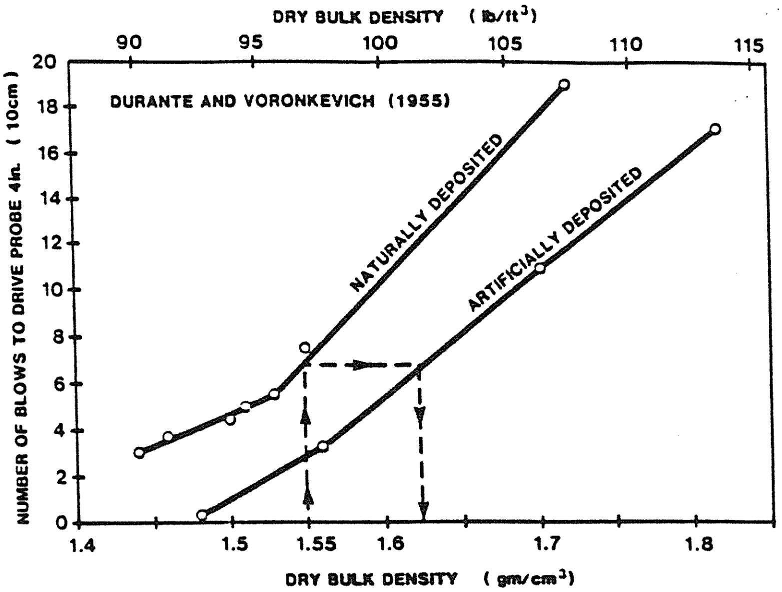

Fig. 3/1 Ageing effect on a sand deposit. Penetration resistance of Naturally deposited and Artificially Sedimented Sand (from MITCHELL 1984).

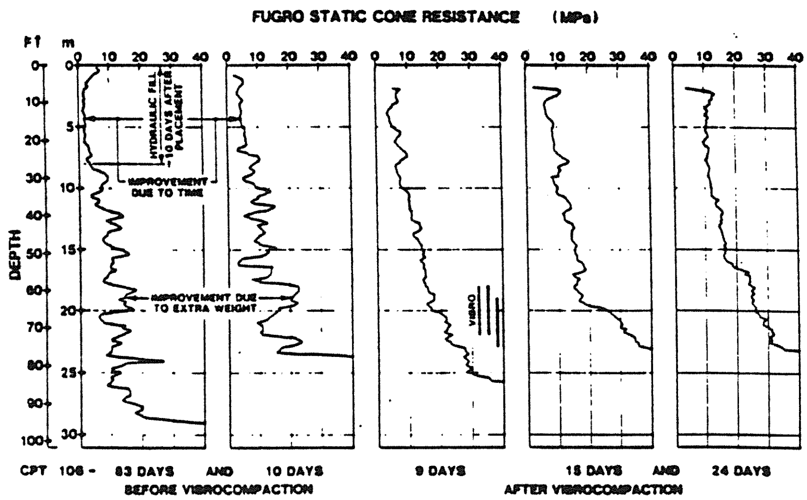

Fig. 3/2 Effect of time after Vibrocompaction on penetration Resistance at Jebba dam, Nigeria (from MITCHELL 1984).

4 PROPOSED ZONING AND MATERIALS

4.1 Stream Cutting Dike

In order to overcome some of the possible drawbacks resulting from the considerations made in the previous chapters, it is proposed that the Closure Dam be built adopting the zoning and materials shown in the enlosed Drawings ELC 049, 050 and 051 and ELC 046, 047 and 048.

The stream cutting dike, needed for river diversion will remain as the dam's downstream toe and free draining zone. Its axis will be set 420 m from the dam axis. Its crest will be at el. 75 m a.s.l. and will be 10 m wide. The stream cutting dike will be built with 50 - 100 mm rockfill formed of subrounded alluvium. The use of blasted or crushed rock will be excluded. The rockfill will be dumped in running water and will be strongly permeated. Its upstream slope, on account of the stabilising seepage forces, will be steeper than suggested its friction angle in the loosest state $\phi'=34°$ and anticipated to result in the range of 1V / 1.5H. Similarly, on account of the destabilizing seepage forces, the downstream slope will be flatter and is expected to be around 1V / 1.6H.

4.2 Centre Dense Zone

Immediately upstream of the free draining toe, the dense zone will be built using pit-run sand and gravel from El Deir, scalped at 100 mm. Over a width of about 10 m centred on the axis of the future permanent cut-off, the pit run material will be added with 10% of the natural fine fraction passing 5 mm sieve (0-5 mm). This is intended to limit segregation and to reduce the overall permeability of the fill in the vicinity of the cut-off. A comparison with the grading limits of para 5.3.5.3 a) of the Technical Specifications shows a substantial agreement except for the 0.6 mm diameter, as shown in Fig. 4/1. A higher content of fines actually corresponds to a better graded and to a denser material. The same figure shows the grading of the sand and gravel used for a fill dumped underwater and later waterproofed by a cast in place concrete cut-off (RAMIREZ 1972).

The sand and gravel zone will extend about 38.0 m upstream

from the axis at el. 73. The upstream slope of this zone will coincide with its angle of repose and will result in a base width equal, or wider than that corresponding to a uniform 3/1 slope.

This zone will be dumped in moderately flowing water up to the actual level of the river at the time of closure which is anticipated to be around el. 73 m plus a reasonable free board. The expected dry unit weight of the pit run sand and gravel from El Deir dumped in water is γ = 19.5 kN/m3 and its void ratio is e = 0.38 corresponding to 85% of the Modified AASHTO Optimum dry unit weight. The dumped fill will be topped with sand and gravel, placed in layers and compacted with heavy vibratory rollers, up to el. 75 m a.sl. It is expected that the vibrations, applied to the top of the fill dumped underwater, will reduce its void ratio by about 4%. In addition the surcharge, represented by the 6.0 m of the compacted crown portion, will further compress the dumped fill. A further reduction of about 1% in void ratio will result. In the end, the dry unit weight of the dumped fill will be increased by 0.5 to 1.0 kN/m3.

The final expected conditions of the dense zone forming the centermost portion of the dam will be γ = 20 kN/m3 and e = 0.33 corresponding to 90% of the Modified AASHTO Optimum dry unit weight as shown in Fig. 4/2.

4.3 Crown

The crown portion of the dam, will also be built with pit-run sand and gravel from El Deir scalped at 100 mm, placed in layers and compacted with heavy vibratory rollers. The compaction shall be that required to achieve 95 % of the optimum dry unit weight corresponding to Modified AASHTO energy.

The expected conditions of the fill in the crown zone will be γ = 22 kN/m3 corresponding to a relative density Dr = 85 % and e = 0.22 as shown in Fig.4/2.

4.4 Upstream Zone

The upstream portion of the closure dam will be built as a hydraulic fill of medium fine sand dredged from the river bottom. In order to minimize the constraints imposed by the pool level, this zone will be filled from a 9 m wide berm at el. 74. It is anticipated that the beach, will extend more than 130 m from the axis of the dam and some 75 m away from the pipeline outlet point. The extent, say

the elevation of the far edge of the beach, will depend on the water elevation in the river in the upstream pool. The lower the pool level the longer will be the beach. It is considered that el 72 m will actually represent a reasonable lower limit. Further extension of the hydraulic fill zone may be obtained by an appropriate relocation of the pipeline outlets.

The expected conditions of the hydraulic sandfill in this zone will be γ = 16 kN/m3 and e = 0.72 corresponding to a relative density Dr = 50 % as shown in Fig. 4/2.

4.5 Safety Level

The main portion of the Closure Dam made with El Deir pit run sand and gravel will be substantially more resistant and less permeable than that built with dredged sand. the value of Relative Density Dr is not significfative in comparing materials of different grain size, shape and mineralogy. Th ecriteria for evaluation should rather be based on the dry unit weight or the average void ratio of the fill.

Referring to the values given in Fig. 4/2 it can be pointed out that while the dredged sand after densification would have a void ratio e = 0.58 (γ× = 17 kN/m3) the sand and gravel would have a void ratio e = 0.33 (γ = 20 kN/m3). The effective drained friction angle would be ϕ' = 36° for the dredged sand after densification, while the sand and gravel would have a friction angle ϕ'= 36° in quite a loose state. At a void ratio in the range of e = 0.30, and under confining stresses in the order of 200 to 400 kPa, the angle of friction of the sand and gravel will be ϕ = 40° (MARSAL 1975). Recent tests on El Deir alluvium provided a friction angle ϕ' = 41° for specimens having a dry unit weight γ* = 21 kN/m3 (HAMZA 1991).

γ = γdry

Preliminary stability analyses of the upstream slope have been carried out considering 4 families of slip surfaces as shown in Fig. 4/3. Each critical surface was identified analysing 10 slip circles with Modified Bishop's Method. The above analyses lead to the following factors of safety:

SURFACE TYPE (see Fig.4/3) (see Fig.4/3)	SOLUTION	SAFETY FACTOR Static	Dynamic (1)
1	SG	2.53	1.74
1	HF	2.21	1.49
2	SG	3.46	2.08
2	HF	3.11	1.82
3	SG	4.40	2.29
3	HF	4.28	2.10
4	SG	5.52	2.46
4	HF	5.84	2.35

1) seismic maximum horizontal acceleration amax = 0.1 g

Similarly as indicated in Fig. 4/2 the overall coefficient of permeability for the dredged sand, vibrocompacted, would be in the order of K = 6 10^-5 m/s (even neglecting the effect of the gravel columns), while El Deir sand and gravel will have an average coefficient of permeability K = 6 10^-6 m/s. The expected difference in permeability would be of 1 order of magnitude.

In the end it is to be mentioned that the wider hydraulic fill counterweights, foreseen both upstream and downstream with flatter slopes, reduce the shear stress in the foundation decreasing thereby the potential for large strains and liquification.

In short, it seems justified to consider that the proposed zoning and materials produce a substantial improvement in the safety of the dam.

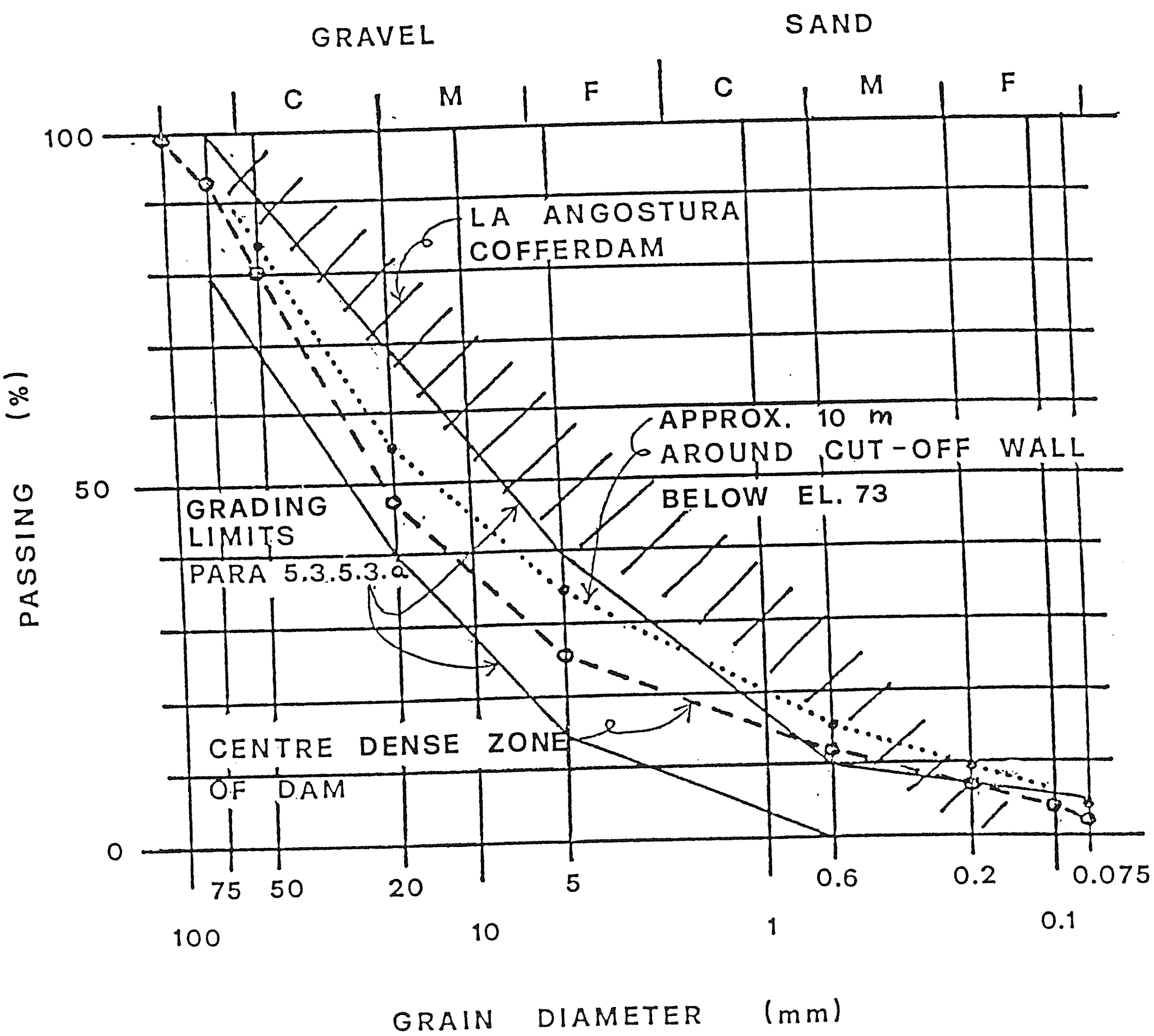

Fig. 4/1 New Esna Barrage. Grading Curves of El Deir pit-run sand and gravel scalped at 100 mm, based on data from the processing plant. Also shown are the gradings of pit-run material added with 10% of the natural fines passing 5 mm sieve, the grading limits of para 5.3.5.3.a and the grading of the fill used at La Angostura Dam (RAMIREZ 1972)

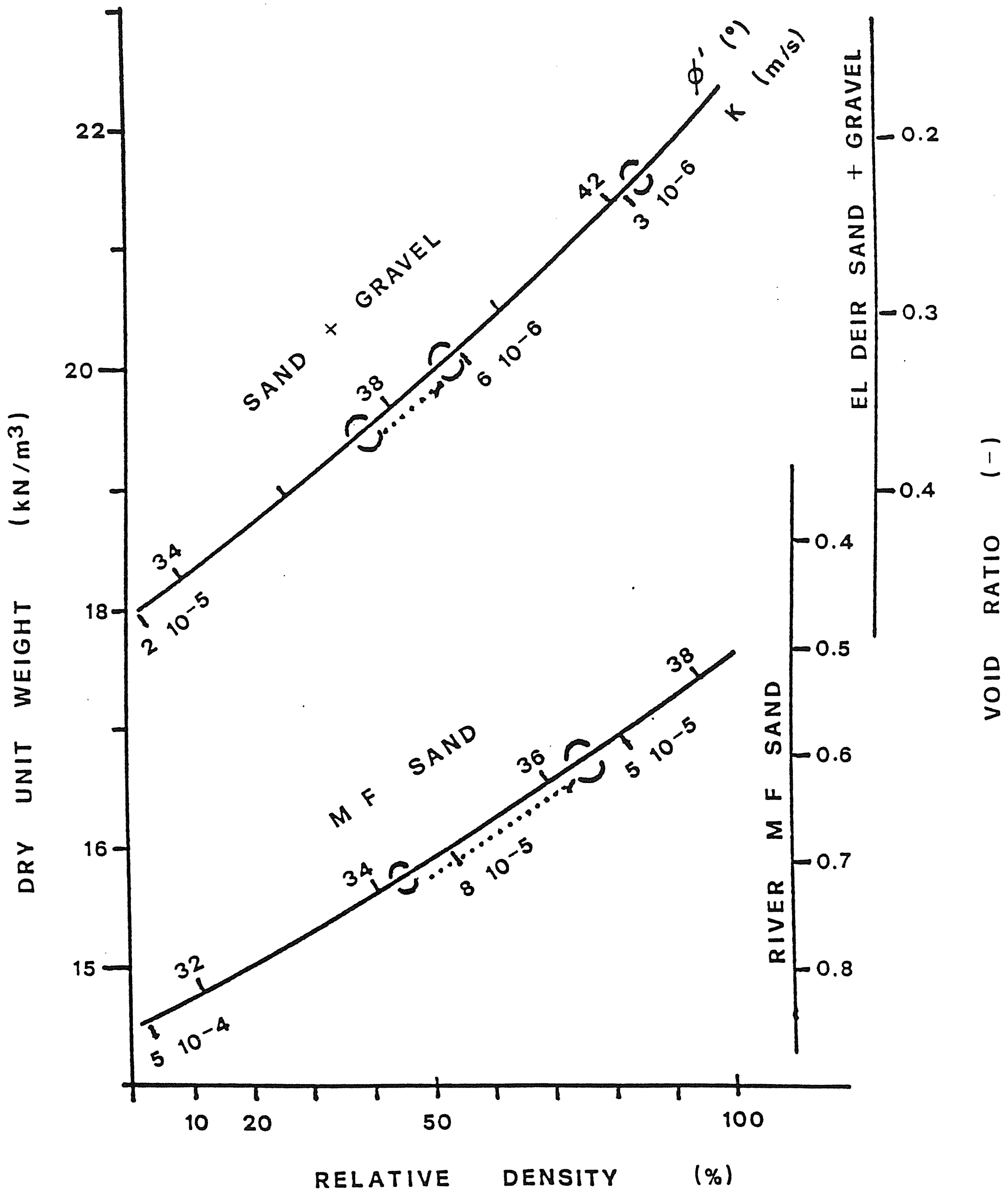

Fig. 4/2 New Esna Barrage. Plot showing void ratios and dry unit weights vs. relative density for El Deir pit-run sand and gravel scalped at 100 mm and for the medium - fine river sand. Relevant values of friction angles and of permeability coefficients are also shown.

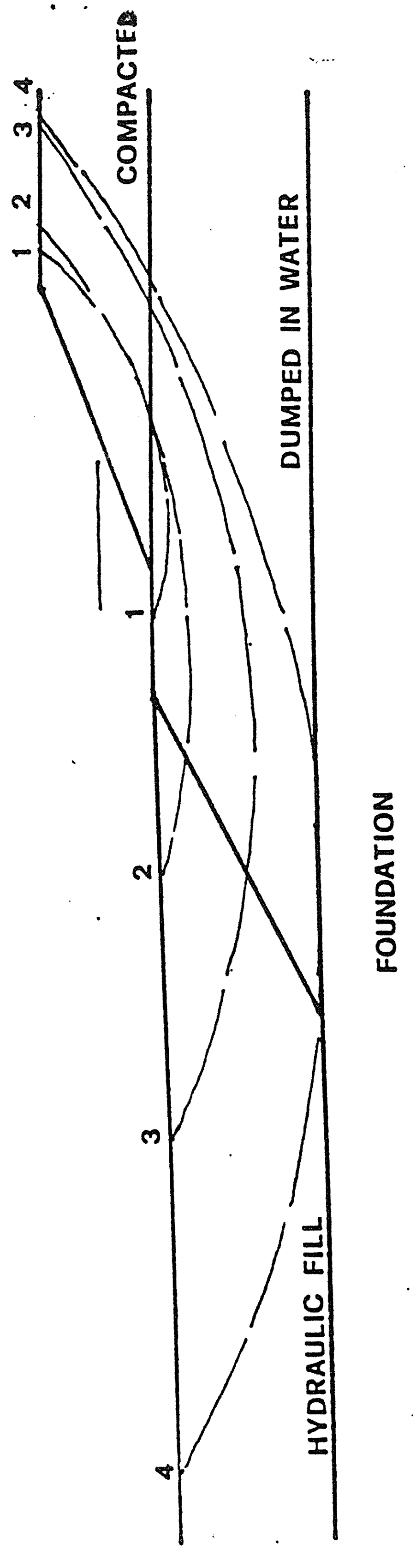

Fig. 4/3 New Esna Barrage. Critical surfaces investigated for the preliminary assessment of the overall safety factor of the proposed cross section.

5 PROPOSED SCOUR AND EROSION PREVENTION MEASURES

5.1 Closure Conditions

The closure of the Nile river will be possible with a moderate head. Numerical analyses and model tests suggest a maximum head differential across the gap of 0.2 m during closure against a 2500 m3/s discharge. The stream velocity through the gap will never exceed 2 m/s and the peak value of the stream specific power will be N = 4 tm/s. Consequently, the final gap of the stream cutting dike may be closed with 50 - 100 mm size rock elements.

It is, nevertheless, necessary to protect the riverbottom from possible localised scouring over the final 80 m of the gap. Here the downstream protection shall extend 55 m to the downstream side of the axis of the dike. Over the remaining of the riverbed the riverbottom scour protection shall be 10 m wider than the dike's base both upstream and downstream.

Once the closure is completed and the closure dam crowned, and prior to the completion of the positive cut-off, the rockfill toe will work as collector for both the embankment seepage and the foundation underseepage. The presence of the diaphragm wall will reduce but never completely eliminate this vital function. Seepage entering the toe drain will entail seepage forces capable of dislodging individual sand grains from the bottom and of carrying them into the voids of the rockfill. There is, in fact, no grading compatibility between the two materials, on the basis of usual filter criteria (SHERARD 1985). In order to prevent suffusion of the foundation sand into the toe a non woven geotextile separator has been foreseen under the entire rockfill toe, from abutment to abutment.

Considering that the geotextile must be placed underwater and loaded with dumped, coarse granular fill, a heavy duty fabric must be adopted. The proposed geotextile is a non woven, cross needle punched, continuous filament, polypropylene fibre geotextile with a unit mass of 1200 g/m2, a thickness of 7 mm, a tensile strength of 40 kN/m, a minimum elongation at failure of 75 %, a punching resistance to the CBR piston of 7000 N, a cross coefficient of permeability k = 10^-3 m/s and an equivalent opening size of 0.05 mm. The reference product is POLYFELT TS 013 of Polyfelt AG. of Linz.

5.2 Filter for the Embankment

The same measure shall be implemented, from the right bank to the spillway, on the boundary between the pit-run sand and gravel and the rockfill toe.

5.3 Slope Protection

A geotextile separator is suggested also under the slope protection, both upstream and downstream. Here the fabric will be placed over an exposed and regular surface. A conventional gauge geotextile will be sufficient. The proposed geotextile is a non woven, needle punched, continuous filament, polypropylene or polyester fibre geotextile with a unit mass of 340 g/m2, a thickness of 2.5 mm, a tensile strength of 25 kN/m, a minimum elongation at failure of 35 %, a punching resistance to the CBR piston of 3000 N, a cross coefficient of permeability k = 2 10^-3 m/s and an equivalent opening size of 0.09 mm. The reference products are POLYFELT TS750 and BIDIM U44.

The upstream pool water level will be kept practically constant at el. 79 m. However, some heavy wave or propeller jet may still be appreciable to a depth of 5 m below the water surface. It is, therefore, suggested that the slope protection be extended to cover the berm at el. 75 and over the sand beach as far as elevation 74 m.

The rip rap is proposed as a single layer of graded rip rap, formed by 50 to 100 mm size, stones, 1.5 m thick (normal to the slope) at el. 74 m and 1.0 thick at maximum pool elevation. The rip-rap can be obtained processing the alluvial materials of El Deir borrow area.

Details of the geotextile separators and of the rip-rap are given in Dwg. ELC 051.

6 PROPOSED ABUTMENTS

6.1 Left Side Abutment

Prior to the construction of the closure dam, both the left and the right abutment should be built and prepared to receive the closure structure proper. It is proposed that the left abutment be filled to the lines and grades shown in Dwg. ELC 046 and 047.

After placing the specified geotextile separator over the foundation the free draining toe shall be built on either side of the existing temporary cofferdam. On the riverside it should extend some 80 m from the cofferdam axis as foreseen in the model study (ELC 1991). The upstream slope of the rockfill toe shall be covered with a geotextile separator, too.

The entire space between the temporary cofferdam and the spillway structure shall be filled reproducing the cross section of the closure dam. The centermost denser section shall be filled with pit-run sand and gravel from El Deir scalped at 100 mm, placed in 0.5 m thick layers and compacted with heavy vibratory roller to the specified dry unit weight. The thickness of the layer is intended after compaction.

Filling should be extended to complete the spillway spur and relevant protections at least up to el. 75 m. The present structure of the temporary cofferdam is to be incorporated in the spur as permanent fill.

If possible, it would be advisable to excavate and cast the plastic diaphragm wall to some distance from the spillway end block, so as to limit the seepage that may tend to channelize along the concrete structure by the presence of the temporary cut-off wall and cofferdam.

Once the diaphragm wall completely casted across the river, the temporary cofferdam shall be trenched out over a 10 m wide strip and replaced by free draining 50 - 100 mm rock fill. This will be done to establish the continuity of the toe drain. The geotextile separator shall be placed over the foundation overlapping the geotextiles on both sides of the trench.

6.2 Right Side Abutment

It is proposed that the right abutment be filled to the lines and grades shown in Dwg. ELC 048, before starting closure operations.

The bank shall be trimmed and a trench excavated to set the toe drain, and the relevant geotextile separators, some 50 m into the bank at el. 71.50 m.

Similarly the centre zone shall be taken inside the present bank profile and filled up to el. 75 m so as to create a platform which may allow a prompt and efficient start-up of the filling operations leading to river closure. The platform shall extend some 100 m beyond point 'C'.

The crown of the closure dam exceeds the elevation of the right bank by more than 2.0 m. It will be, therefore, necessary to construct a bund along the alignment selected for the road. This bund will have width and profile identical to the top portion of the closure dam and will extend, as far as topography demands, towards the Cairo-Aswan national highway.

An early completion of the crown of the closure dam on the right bank and the access road leading to the national highway, would greatly assist the hauling of fill material from El Deir borrow. Suitable ramps shall connect the embankment having different elevation.

In order to prevent any by-pass seepage on the right bank, it is suggested that the plastic concrete diaphragm wall be extended some 140 m beyond point 'C'.

If convenient, the relevant section of the plastic concrete diaphragm wall beyond point 'C', could also be excavated and cast as part of the works of this abutment.

A sizeable erosion presently indents the bank shortly upstream from the dam axis. This scallop, if not treated, will increase the amount of seepage moving around the right end side of the closure dam. It is suggested that this depression be replenished with hydraulic sand fill. A proper structure will likely be needed to retain the dredged materials along the riverside. To this end, a dike, parallel to the river and with crest at el. 78, has been foreseen. This dike should be built with El Deir pit-run sand and gravel scalped at 100 mm.

6.3 Diaphragm Wall Connection with Spillway

The permanent plastic concrete diaphragm wall shall be built across the entire left and right abutment structures. Its construction can be either done after closure completed or staged and partly advanced as the abutments are built.

As shown on the enclosed drawing ELC-046 a special contact arrangement, including 1 or 2 diaphragm panels placed crosswise, and a recessed waterstop are recommended to be provided against the spillway end block. The concrete end block will be shaped so as to allow an easy excavating of the contact panels and to produce a geometry favouring a progressive confinement of the fill downstream from the cut-off, under the action of consolidation and downward movements induced by the hydrostatic forces. The end block geometry will also be such as to make the hydrostatic pressure increase the effective pressure along the diaphragm-spillway pier contact surface thus making the seal more effective.

A 0.35 m wide, rubber waterstop will be installed in a recess which will be filled with clean sand as the fill for the dam is raised. The excavation of the end panel of the cut-off wall should completely remove the sand from the recess allowing it to be filled with plastic concrete at casting time.

As an extra precaution, a 3.0 x 3.5 m zone of the fill will be made with sand and gravel scalped at 25 mm and added with 5% powdered bentonite to form a more plastic and less pervious plug. The contact between plug and concrete wall will be made with a mix of sand (<2 mm) and bentonite (10% by weight), moderately wetted and compacted in 0.1 m layers by hand tampers. The sand and bentonite mortar shall be 0.1 m thick.

7 CONSTRUCTION STEPS

7.1 Staging

The construction of the proposed closure dam will entail 2 main stages: the preparatory works and the closure proper.

The fundamental rule of any closure requires that it should start quickly and progress smoothly without being hindered by the often complex and slow works for the abutments. The closure operation will consist of a few simple and massive operations. Another requirement for a safe closure is the availability of sufficient parking, manoeuvring and stockpiling space at both ends of the stream cutting dike.

The above mentioned requisites for a safe closure asks for the early construction of the end portions of the closure dam on each bank. Ideally the preparatory works should be implemented during the low water season of 1991 while the closure dam is foreseen for the following year of 1992.

7.2 Preparatory Works

First the geotextile separator will be placed over the river bottom. This will be a waterborne operation and can be accomplished in different ways. One of the method which results to be suitable for the New Esna Barrage is stated hereinafter.

The geotextile will be placed in bands parallel to the river stream. A pontoon will be needed and several rolls of geotextile shall be sewed together prior to let them overboard. Probably 3 to 4 rolls, each 5 m wide, may be sewed to form a 20 m wide sheet. It is suggested that the required total length of sheet be lowered to the bottom rolled up, to help sinking, and hence laid down pulling the roll toward downstream. The geotextile will be held to the bottom with gravel ballast. The pontoon will hence move downstream laying the geotextile to cover the required length. This operation will require the assistance of frogmen. The geotextile protection will be longer under the 80 m width of the final gap. The overall heavy gauge geotextile quantity will be about 25000 m2.

A 50 -100 mm rocky ballast shall be placed over the geotextile as soon as the laying is completed. Its volume will amount to

15000 m3 approximately.

The left side abutment will be built as previously recommended and will abut against the spillway. The rockfill toe shall be placed also inside the present excavation and taken against the downstream wrap-around wall.

Upstream from the rock toe, pit-run El Deir sand and gravel scalped at 100 mm will be placed in compacted lifts to fill the existing excavation extending as far as the spillway upstream training wall. The portion immediately adjacent to the spillway end block will be filled up to el. 81 m to allow casting of a few panels of the permanent cut-off in case this casting of panels becomes necessary.

The spillway spur shall be filled to design grades and all slope protections shall be placed working both in the dry and underwater.

The right bank abutment structure will have the cross section previously suggested and identical to that of the closure dam. Appropriate ramps will connect to those parts built up to el. 80 further inland.

The road embankment should be built to its final grade, connected to the national highway.

Some 2000 m3 of 100 - 200 mm cobbles shall be stockpiled near the end of the stream cutting dike of the left abutment. This material must be ready for use in case of unexpected difficulties at the time of closing the final gap. The suggested volume will allow building 30 m of the stream cutting dike . The stockpiled material can be used either to fight the stream when specific power peaks off, or to speed up closure. In case it will not be needed, it may serve to form later that part of the free draining toe which is now occupied by the cofferdam.

7.3 Closure

Assuming that most preparatory works would be done during the low water season of 1991 and in the 1991 - 1992 winter, the best time for closing the Nile will be October 1992 or earlier. To this end, closure operations should start around July 1992.

Closure will require about 15000 m3 of 50-100 rockfill plus 160000 m3 of El Deir pit-run sand and gravel dumped underwater. Some 50000 m3 of compacted pitrun sand and gravel, also from El Deir, will be needed to complete the crown

portion of the dam.

The closure operation shall start filling the 50 - 100 mm rockfill, from the right abutment. The operation will proceed by end tipping from elevation 75.0 m . While this operation progresses, the water level will decrease and it may result feasible to lower the tipping level.

A fine gravel and sand rolling course may be necessary over the crest of the dike.

As the finished stream cutting dike advances, a geotextile separator is placed against its upstream slope. The geotextile shall be long enough to overlap the geotextile placed over the bottom. There will be about 7000 m2 of heavy gauge geotextile to separate the sand and gravel from the rockfill. This operation will be entirely similar to that performed at James Bay, La Grande 1 and Caniapiscau Project (LAFLEUR 1991) which should be reviewed and taken into account. Such operation will be assisted by frogmen.

Once the geotextile is in place the centermost zone of the closure dam will be filled with El Deir pit-run sand and gravel. Also this filling will be done working about 1 m above water and will be adjusted to the river level variations. The platform being advanced at nearly the same pace of the stream cutting dike will provide a turn-around and waiting space for all equipment at short distance from the tipping front of the stream cutting dike. This will enhance both the efficiency and the safety of the closure.

The fill shall be dumped from the lorries at some distance from the platform edge. A fleet of large bulldozers will then form a heap of fill material as steep as possible and as high as feasible just at the edge of the platform trying to produce a failure of the heap and of the slope underneath. The goal is to have the fill sliding in the water in large windrows which will reduce both wetting and segregation. An alternate procedure could be similar to that adopted at Luossajarvi dam in Sweden (LILIEBERG 1967). After the heap of new fill is formed at the edge of the platform, bulldozer push the sand and gravel downward and into the water forcing a mass displacement along a plane flatter than the material's angle of repose. During the construction every effort shall be made to implement and to optimise such a technique.

Subsequently, the platform level will be raised to el. 75 with conventional compacted lifts 0.5 m thick. Heavy rolling (12 passes) will be applied to each lift and to the surface of the platform. The pit-run sand and gravel platform will

meet with the left abutment shortly after closure is completed.

7.4 Crown

Once embankment is raised to elevation 75.0 m the top portion of the dam will be quickly placed in 0.5 m thick compacted lifts up to el 81 m. The crown will be completed working back from the left bank toward the right, in sections, creating construction joints on a slope of about 4V / 1H. This is intended to open up a working platform for the excavation and casting of the permanent diaphragm wall. The crown zone will require about 115000 m3 of Compacted El Deir pit-run sand and gravel.

7.5 Cut-off

The cut-off shall be built according to the methods and specs adopted for the same work under the concrete structures of the dam. In the deepest portion of the river the width of individual panels shall be in the order of 2.5 m until a sufficient number of panels will prove feasible excavating two or more contiguous panels before casting. Even and odd panels shall be excavated and casted alternatively so as to keep down to a minimum the length of unsupported excavation.

The cut-off excavation and casting will be done from a working platform at el. 81. The guide wall for the cut off shall be constructed up to elevation 81.0 m. The diaphragm will cut through compacted pit-run sand and gravel from El Deir for about 7 m, through the same material dumped underwater for a length ranging from 0 to 11 m, and hence, through about 20 m of medium fine in situ sand and medium coarse in situ sand. Similar conditions were encountered and successfully overcome at La Angostura cofferdam n. 2 in Mexico (RAMIREZ 1972). Fig. 4/1 shows the grading of La Angostura sand and gravel for reference.

This scheme has been adopted and successfully constructed in several cases reported in the literature. Arrow Creek dam can be mentioned amongst others where a 700 m long and 45 m deep diaphragm was excavated and casted. The top 25 m of the diaphragm were contained by a sand and gravel dike (DES CHAMPS 1965).

In order to reduce the losses of bentonite mud without slowing down of the excavation rate at the transition between fill and foundation, it is suggested that rotary holes be drilled from the platform at el. 75 and that they be low pressure injected with a slow-hardening mud. Such holes should cover only 200 m in the centre of the dam and should be

drilled in 2 rows one on each side of the future diaphragm. The typical spacing could be 3 m both ways. The typical injected mix could be 40% silt + 50% cement + 10% bentonite by weight. Appropriate tests on the mix will be necessary. The result of the early injections will be used to optimise the hole spacing.

7.6 Upstream Zone

The hydraulic fill forming the upstream portion of the dam can be placed as soon as the pit-run sand and gravel zone is filled up to el 73/75 m, i.e. shortly after closure. A berm at the edge of the platform has been foreseen to accommodate the pipeline and to service the outlets.

7.7 Finishing

While the diaphragm wall is being built, the slopes will be trimmed and the relevant geotextile separators and rip-rap protections may be placed.

There will be about 55000 m2 of light gauge geotextile and 50000 m3 of 50-100 mm rip-rap to be placed.

This operation will be entirely similar to that performed at James Bay, Fregate Dam (LAFLEUR 1991).

8 QUALITY CONTROL CRITERIA AND METHODS

8.1 General

The closure dam will consist of 3 parts built with different procedures and in different conditions: underwater dumping, conventional compaction in lifts, hydraulic filling. Each part will require a different approach and different procedures for quality control.

The indications stated below are proposed to be considered by the Engineer to complement the quality control criteria given in the Tender Design and Documents.

8.2 Underwater Sand and Gravel Fill

The El Deir pit-run sand and gravel dumped underwater can be quality tested for quality only once the platform is completed up to el. 75. In this assumption the depth of dumped fill to be tested will not exceed 12 m. Actually only over 80 m of length across the river, will the dumped fill exceed the height of 10 m. Some 250 m of the fill will be less than 10 m in depth and 150 m will actually not attain the 5 m mark.

The most commonly used method for assessing the density of an underwater dumped fill is based on some kind of penetration test interpreted through appropriate correlations.

The grading of the El Deir pit-run sand and gravel (0 -100 mm) is actually rather coarse to allow to have meaningful results using standardised penetration tests. The size of standard spoon or cones being far smaller than the diameter of the coarsest elements present in the fill, hence the need for using non standard probes becomes evident.

It is proposed that a wide flange steel post be used, and that penetration be achieved with a commercial impact diesel hammer, pile driving equipment. Correlations between relative density and number of blows for a given penetration, which should not be less than 0.5 m, shall be obtained at an appropriate trial test.

Rows of 3 driving tests, respectively 10 m upstream, 10 m downstream and 25 m downstream from the dam axis, spaced 50 m along the axis will be done. During each driving, 3 blow counts shall be done at depths of 4, 6 and 8 m below el. 73.

This gives a blow count every 4000 m3 of underwater sand and gravel fill. The driving tests in the deepest section of the river (100 m) shall be performed 60 days after completion of all filling to el.75.

The limit of acceptability for the dumped pit-run El Deir sand and gravel shall be based on an average density γ = 19.5 kN/m^3 for the 3 tests at each driving point. When failing to prove the required density, additional compaction will be applied to the platform surface in form of 10 passes of a 140 kN static weight smooth drum vibratory roller.

An alternative control method could be seismic surveying of polarized shear waves produced by oriented and monodirectional mechanical pulses and picked up by unidirectional closely spaced horizontal geophones (Stokoe et al., 1983). Some limitations may however arise from the limited experience available with this type of tests and from the fact that field conditions will not correspond to those of level ground.

8.3 Underwater Sand Fill

The underwater sandfill, deposited hydraulically does not require a quality control given its position to the upstream of the centermost and self standing section. It is, however, suggested that some tests be done also on the hydraulic fill for record. Standard penetration tests SPT with split spoon sampler may be used on account of the many correlations available. It is proposed that the testing equipment include, beside standard spoons and rods, a monkey trip device. Schmertman's or Marcuson's correlations will be used to derive the relative density of the fill at any tested depth.

Quality assessment tests will be performed on the surface of the compacted fill above water level. There will be 2 lines of SPT borings located at 70 and 100 m from the closure dam axis. Tests will be performed working on the surface of the fill or from a low, temporary embankment sufficiently high as to allow unrestricted landborn working. There will be a line of 2 SPT holes every 30 m along the dams axis. The spacing of the blow count will be 1.5 m along each hole this giving 1 SPT blow count every 1500 m3 of fill.

There will be no lower limit for the acceptance of the hydraulically filled sand.

8.4 Compacted Sand Gravel Fill

The compacted Sand and Gravel fill requires conventional

controls through Dry Unit Weight determinations, Grain Size analyses and AASHTO compaction tests. The above tests should be carried out every 2500 m3 according to para 5.3.6.4 of Technical Specifications.

The limit of acceptability for the compacted pit-run El Deir sand and gravel shall be $\gamma = 21\ KN/m^3$ with a possible 15% of the results falling above 90% of the specified limit.

The acceptable limit of grading will be in accordance with the curve of Fig. 4/1 with deviation of 10%. One in five grading tests may deviate up to 15% from the said curve.

The dry unit weight determinations should be carried out from a level and smooth surface with the Oroville Ring device and procedure set up for the trial test.

9 TRIAL TEST ON EL DEIR SAND AND GRAVEL

9.1 Location and Geometry

Following are some suggestions and indications regarding a trial test on El Deir alluvial materials. Final detailed planning and procedures for the execution of such tests shall be provided in a separate document.

The aim and scope of the trial test is the definition of correlations applicable to a blow count of a commercial diesel hammer, driving a standard wide flange steel pile and the unit weight of the fill. The steel pile may be provided with a shoe having a triangular (45) section and a 5 mm overwidth with respect to the profile so as to reduce the side friction.

The left bank abutment structure, between the spillway's end block and the temporary cofferdam, seems the most adequate location for the trial embankment. The testing ground will be better located near the concrete structure, where the fill depth exceeds the 10 m mark, and upstream from the closure dam axis. Such location will leave the test fill practically outside the body of the dam and confined by the training wall. Thus, the presence of loose fill should not jeopardize the performance of the closure dam.

The trial embankment should consist of a fill placed in lifts some 0.6 m thick, and compacted with a 140 kN overall static weight roller. The static weight applied by the drum shall be not less than 100 kN. The roller shall be vibratory of the smooth type drum, with nominal vibration amplitude between 0.9 and 1.8 mm and vibration frequency between 27, at high amplitude, and 32 Hz, at low amplitude. The reference roller is Dynapac CH 51 D.

The embankment overall thickness shall be at least 10 m and its minimum dimensions shall be 20 x 20 m. Within the test area 2 strips 20 m long and 5.5 m wide shall be identified and compacted respectively with 2 passes one of static roller and one of vibratory roller, (one static and one vibratory) and 8 passes of vibratory passes in order to create a fairly loose and a fairly dense fill. The 2 strips where a controlled compaction is applied, shall be separated and surrounded by cushion strips 4 m wide to which only a nominal compaction is applied so as to isolate the loosely compacted strip from the vibrations coming from adjacent,

heavily compacted one.

9.2 Testing

As the test strips are built up the dry density of the compacted sand and gravel will be measured with the Oroville ring procedure. The ring diameter shall be 1.2 m at least. A reference volume will be measured with a thin polyethylene film and water and the same procedure will be used to measure the volume of the hole excavated to recover the soil. Water content and grains size shall be determined on the entire weight of the excavated material.

Two Density measurements shall be done every second lift at 1/5 and 3/5 and at 2/5 and 4/5 alternatively along the test strip length. From density measurements an initial density profile of each test strip will be drawn.

Once the fill completed and the 2 strips fully tested, 2 driving tests will be made midway between the density testing points. The loose strip shall be tested first so as to avoid any density increase which may come from the driving vibrations. Three blow counts shall be made recording the number of blows required to drive a 160 mm wide flange steel pile, for a distance of 1.0 m. Prior to starting the blow count the steel pile will be withdrawn 0.2 m and hence driven with 1 single blow. Three consecutive blow counts shall be made starting 6, 8 and 10 m below the surface of the fill. In addition to the blow count at the specified depths, the number of blows needed to advance the steel pile each metre shall be recorded all the way down, starting from the surface.

Once the 4 driving tests are completed, the surface of the fill shall be ponded with 0.1 m of water. The water shall be retained with a bund and supplied by adequate pumps. Ponding shall be continuous for at least 100 hours. The goal of ponding is to achieve near saturation of the fill.

After the saturation, 2 more driving tests shall be made at the centre points of each test strip with the same procedure previously adopted.

9.3 Correlations

Using all the recorded data, the densities of the compacted fill will be assessed and a correlation between unit weight and blow count will be attempted both for dry and for saturated fill conditions. If applicable a correction for overburden stress will be proposed. The blow count pertaining

to a fill possessing a given relative unit weight shall serve as quality control beacon.

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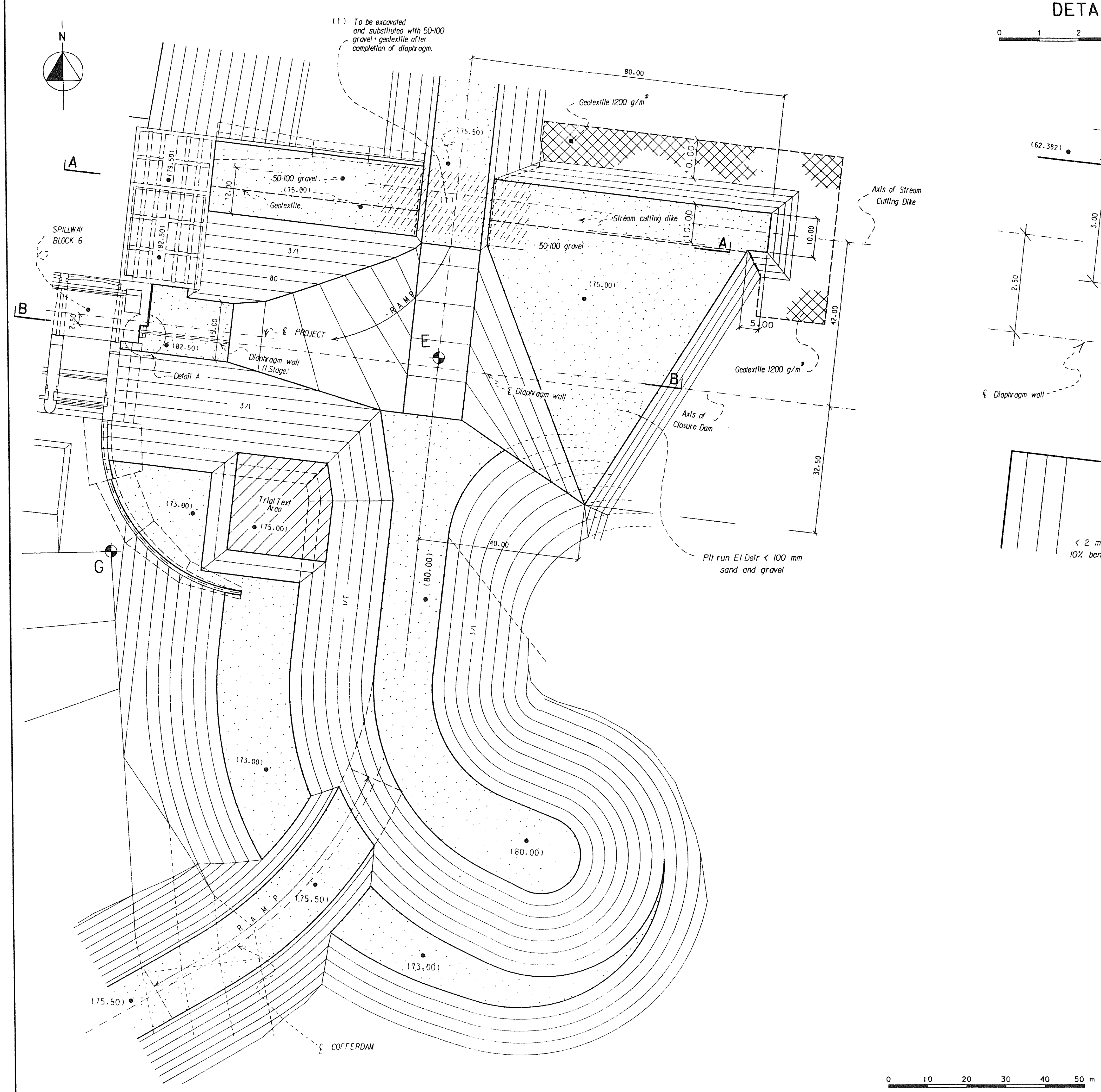
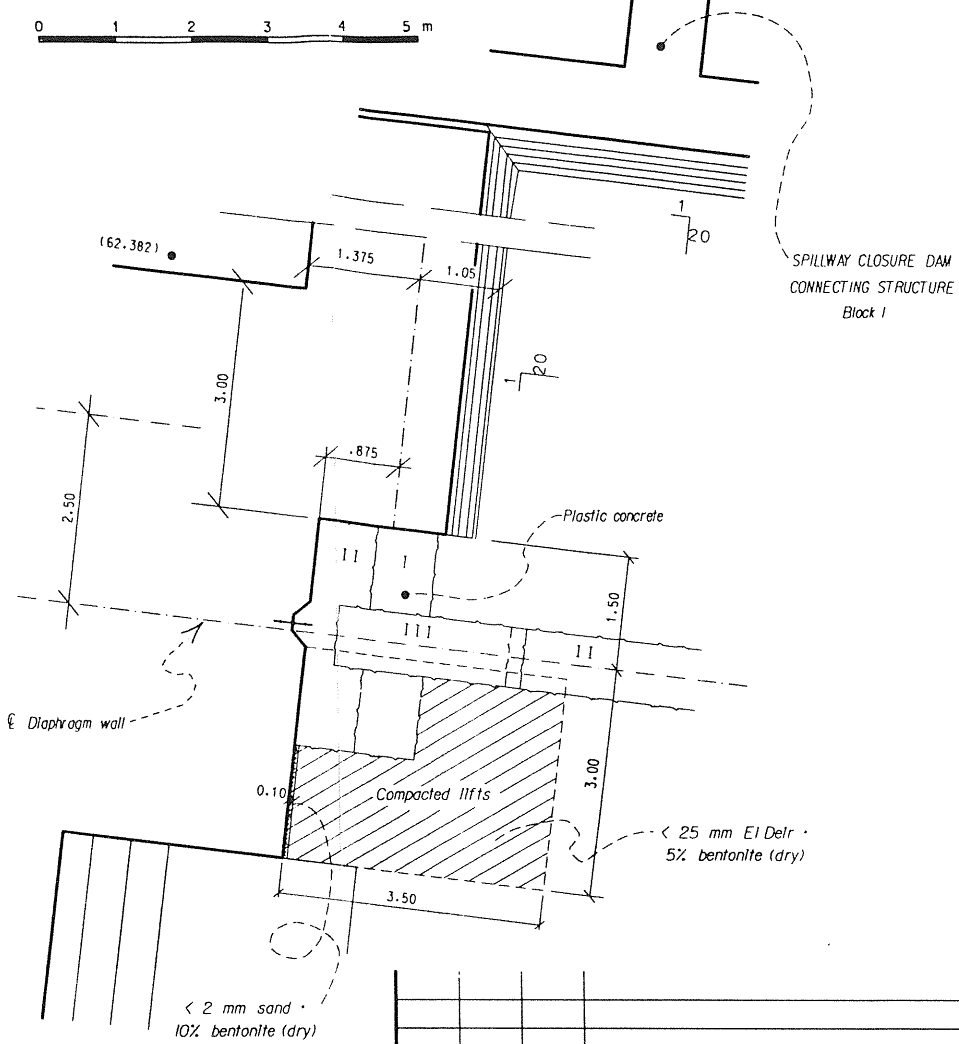


DETAIL A



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TITLE: CLOSURE DAM
LEFT ABUTMENT - I STAGE
PLAN AND DETAIL

DRAW. N°: ELC-046

ARAB REPUBLIC OF EGYPT

MINISTRY OF PUBLIC WORKS AND WATER RESOURCES
RESERVOIRS AND GRAND BARRAGES SECTOR

NEW ESNA BARRAGE AND POWER PROJECT

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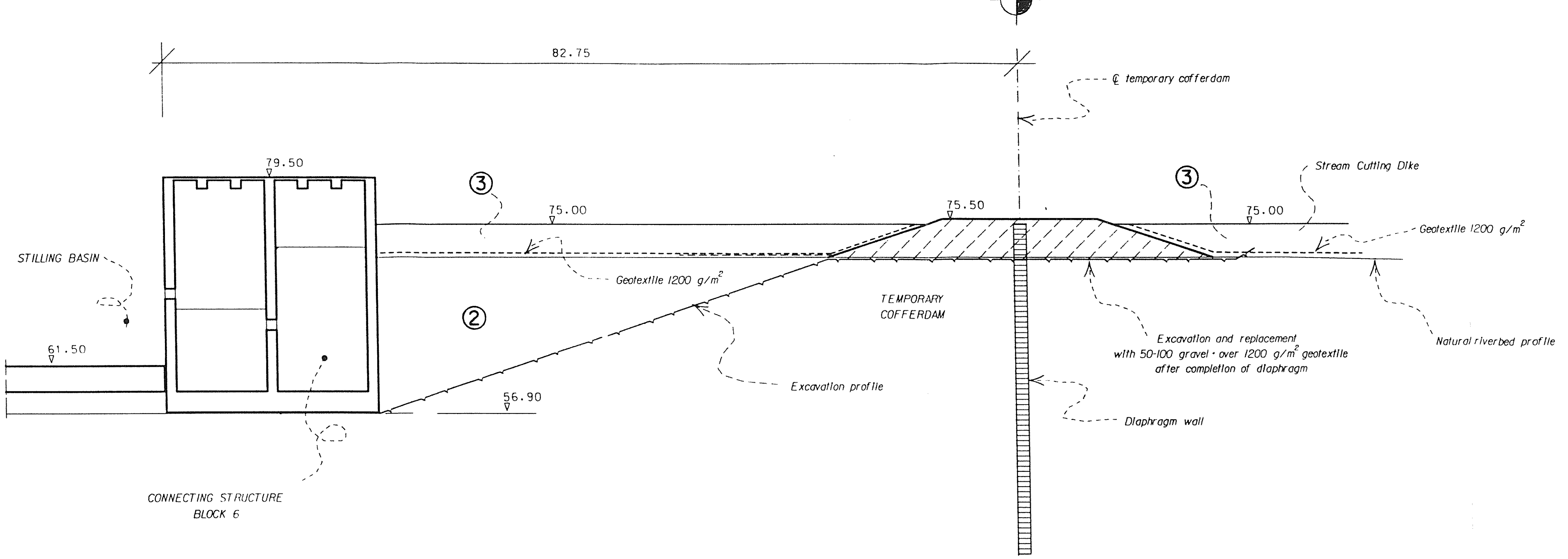
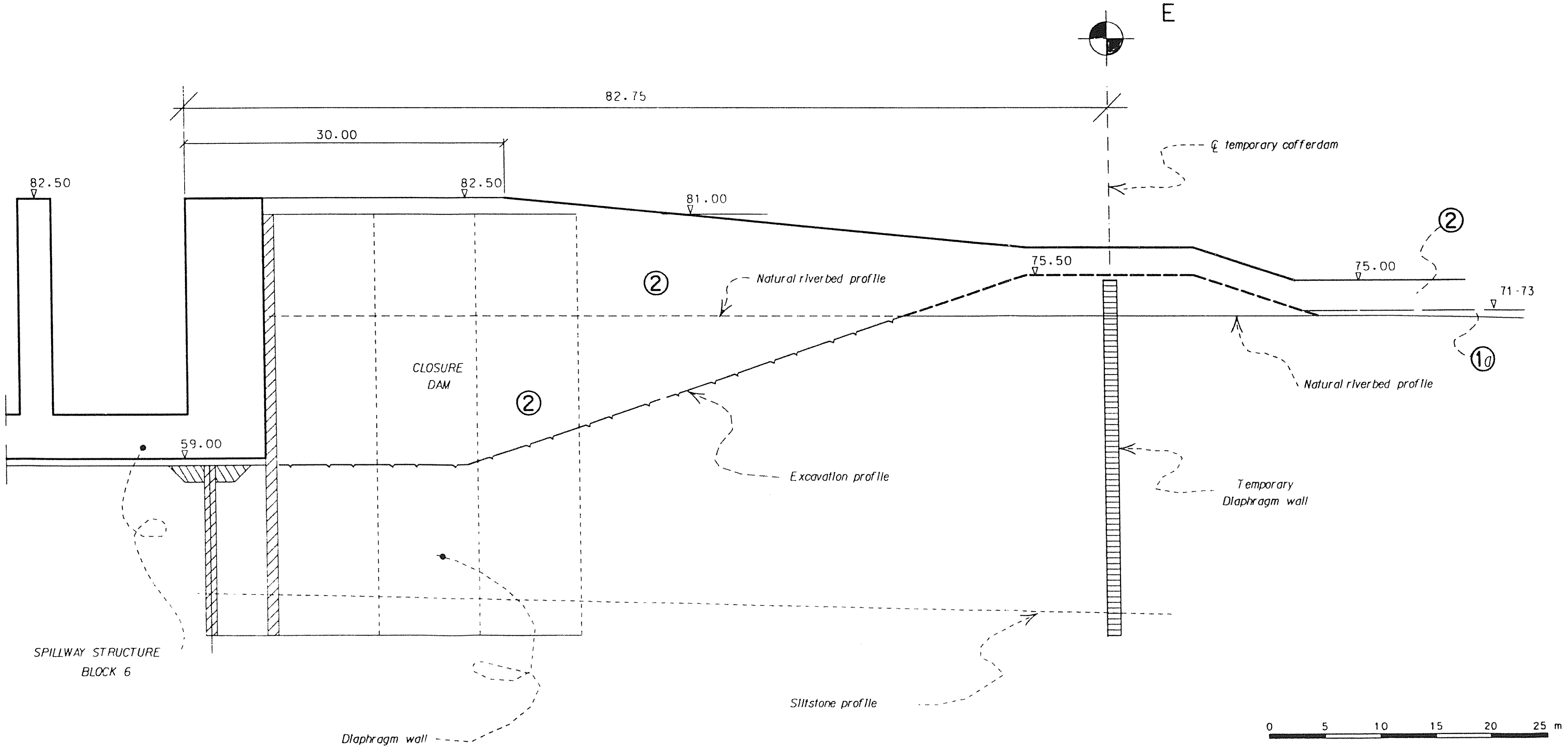


(1a) Pit-run El Deir (gravel + sand) < 100 mm added with 10% of < 5 mm fraction

(2) Pit run El Deir (gravel + sand) < 100mm placed in 0.5m lifts compacted with vibrating roller

(3) Rockfill 50-100 mm excluding quarried or crushed materials

B - B



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TITLE: CLOSURE DAM
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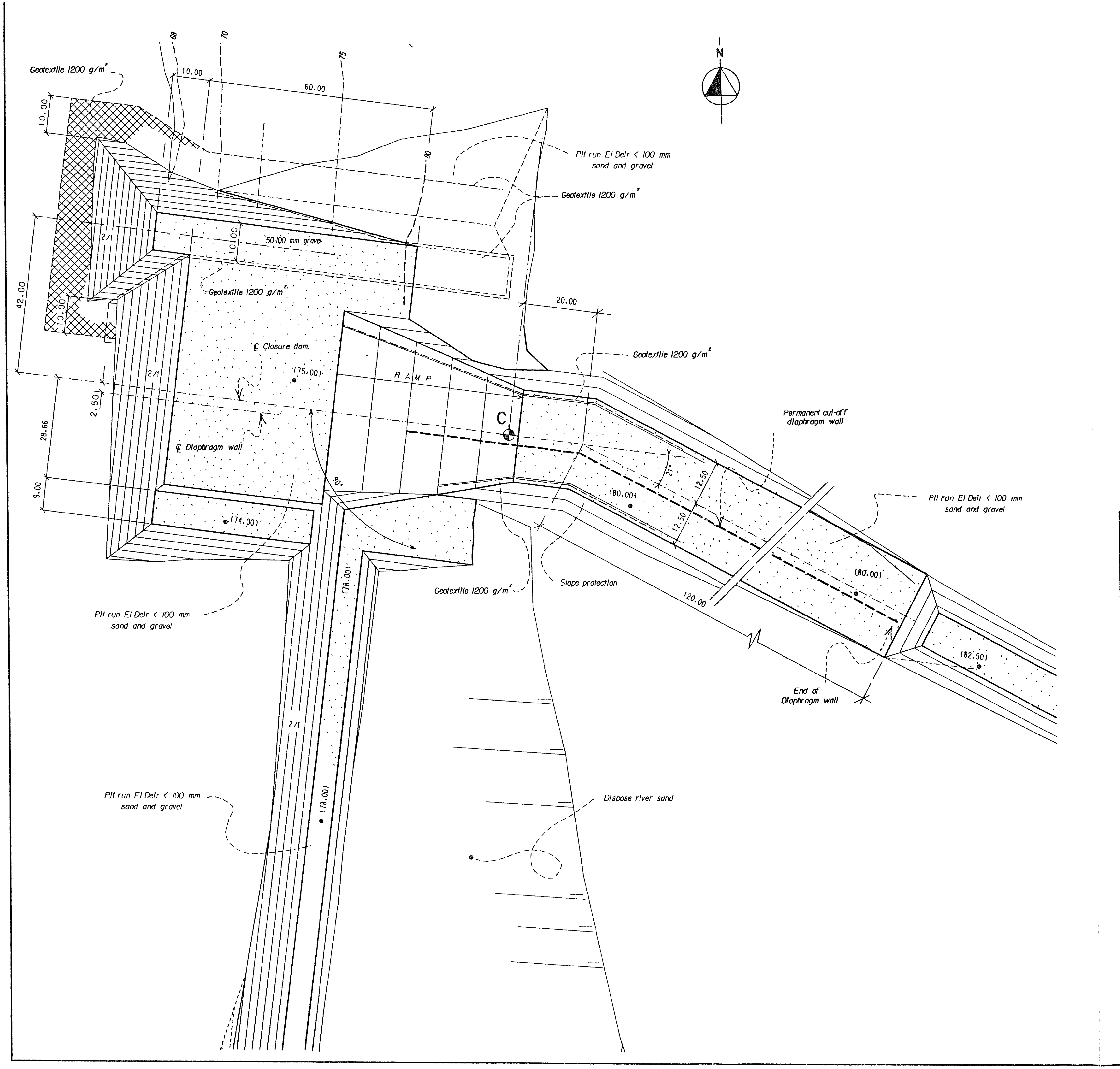

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TITLE: CLOSURE DAM
RIGHT ABUTMENT - I STAGE
PLAN

DRAW. N° ELC-048

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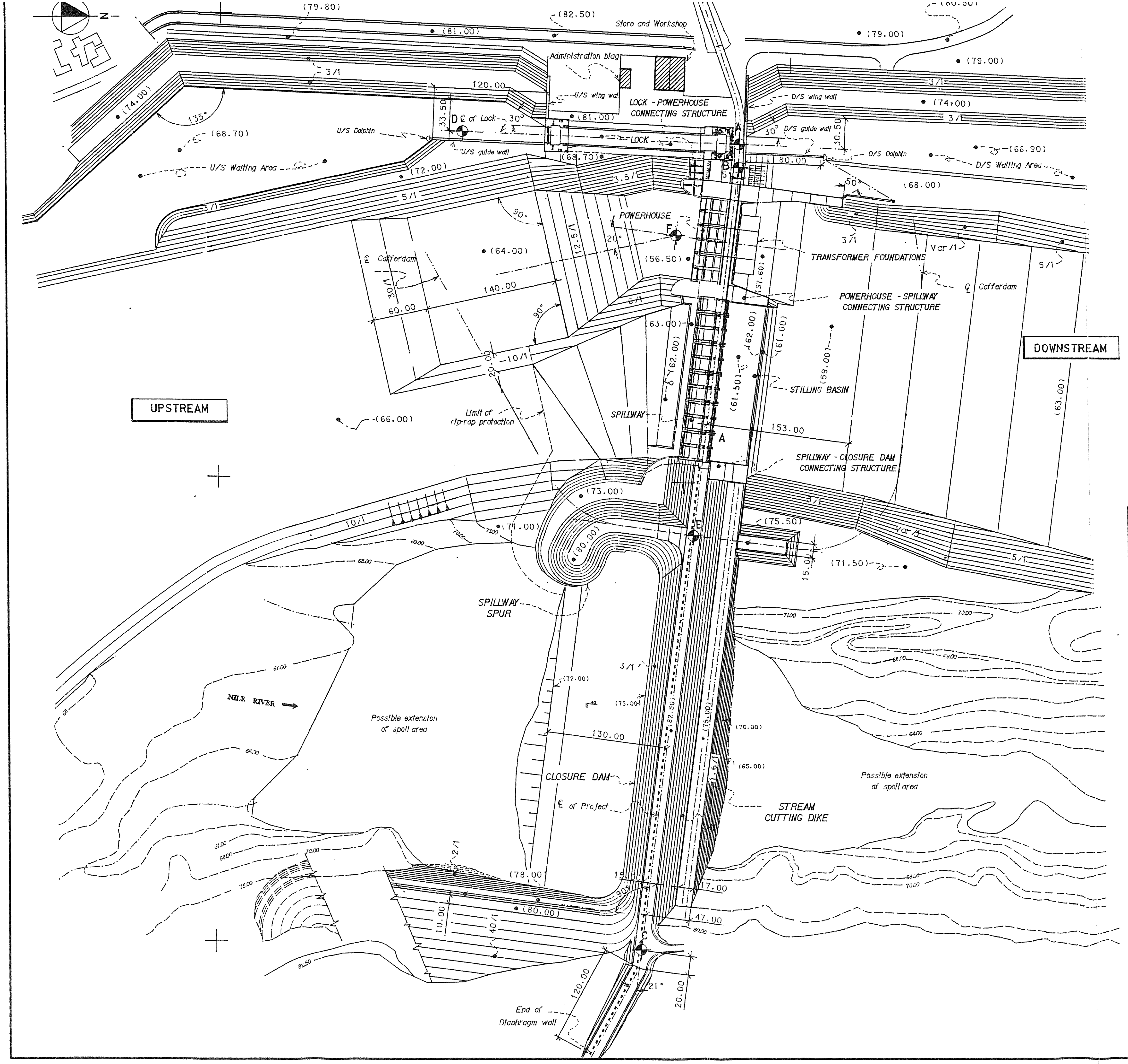

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D	291 760.183	771 124.530
E	292 010.380	771 557.003
F	291 991.164	771 233.893

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DATE: MAY 91 — SCALE: 1:2000 — CHECKED — DRAWN

TITLE: CLOSURE DAM
FINAL LAYOUT PLAN

DRAW. N°: ELC 049

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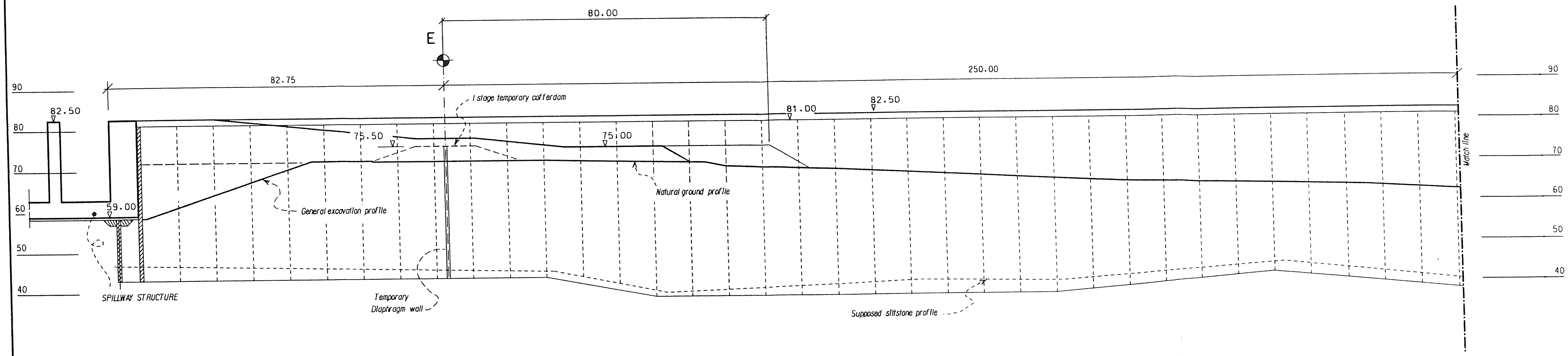

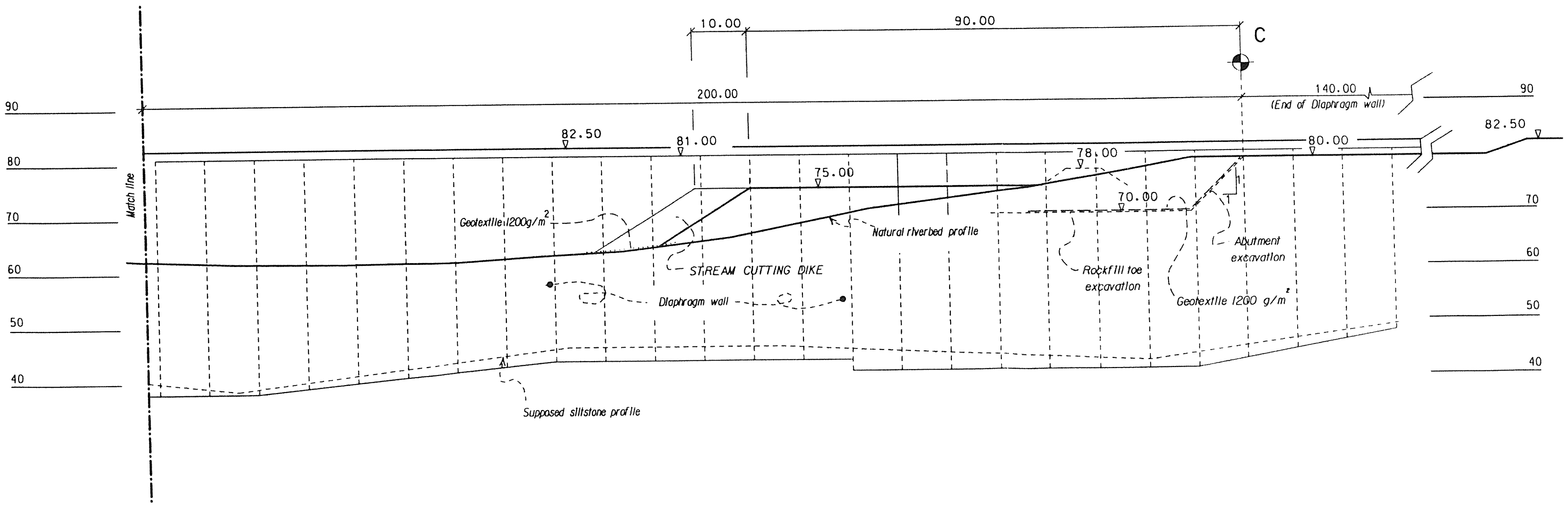

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TITLE: CLOSURE DAM
LONGITUDINAL SECTION

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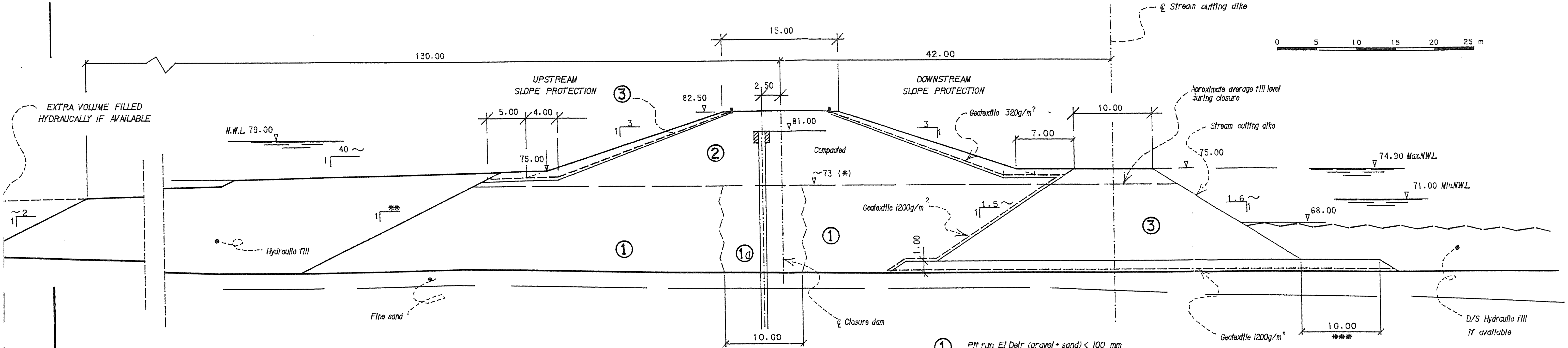
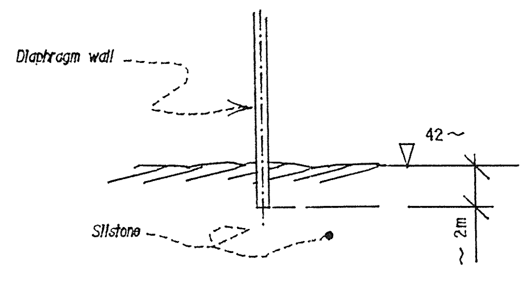




① Pit run El Deir (gravel + sand) < 100 mm

①a Pit-run El Deir (gravel + sand) < 100 mm added with 10% of < 5 mm fraction

② Pit run El Deir (gravel + sand) < 100mm placed in 0.5m lifts compacted with vibrating roller. Zone 2 starts above closure fill.

③ Rockfill 50-100 mm excluding quarried or crushed materials

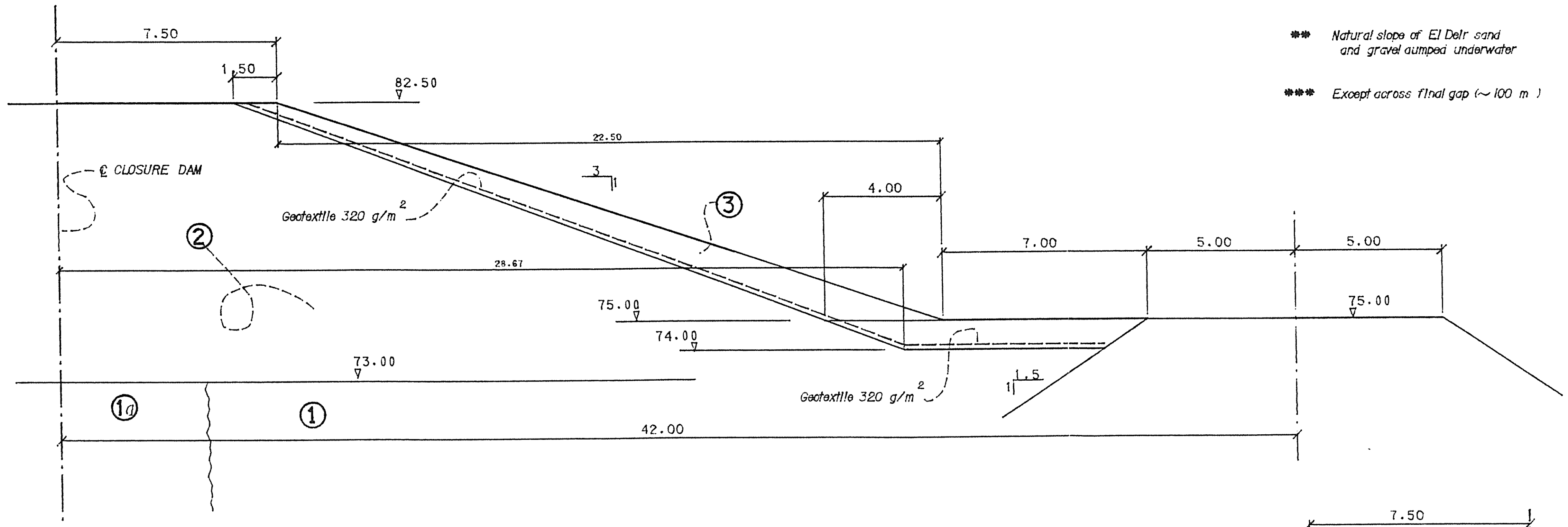
* 1.00 m above river stage during closure

** Natural slope of El Deir sand and gravel dumped underwater

*** Except across final gap (~ 100 m)

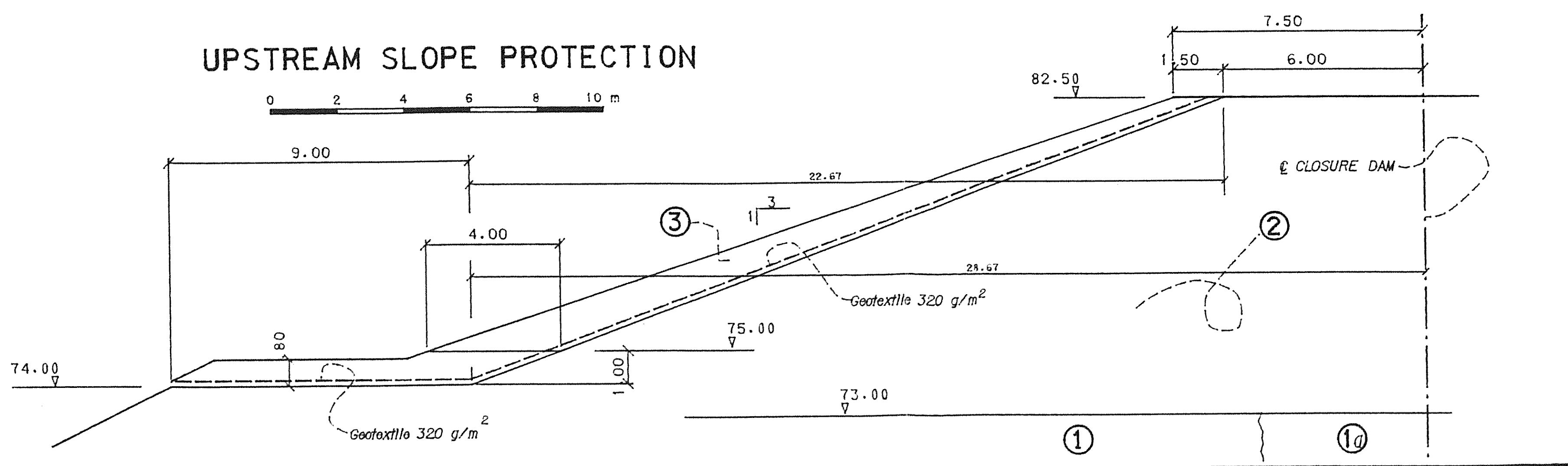
DOWNSTREAM SLOPE PROTECTION

0 2 4 6 8 10 m



UPSTREAM SLOPE PROTECTION

0 2 4 6 8 10 m



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TITLE: CLOSURE DAM TYPICAL SECTIONS

DRAW. No: ELC-051

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EDIZIONE PRODOTTA DA PERSONAL COMPUTER CADD A1

مرفق رقم (٥)

NEW ESNA BARRAGE AND POWER PROJECT

MINUTES OF MEETING held at CAIRO UNIVERSITY on 17 September 1991.

In attendance :

EDIPCO : Eng. ABDEL MEGUID, Consultant RE
Eng. KAMEL RIZK
Eng. HASSAN ASHOUR
Prof. ABOULEID, Special Consultant
Dr. MAMALOUK
Dr. BADR

SOGREAH Mr. LEJEUNE
Mr. MONCLAR

IGL-COG JV : Mr. CALDANI
Mr. LABIGALINI
Mr. ROBINSON
Dr. SEMBENELLI, Special Consultant
Dr. HAMZA, Special Consultant
Mr. MEMON, ELC
Ms. MOGLIA, ELC

Introduction

Professor Abouleid welcomed all the participants and stated that the objective of the meeting was to discuss the suitability of the construction details of the closure dam as set out in the Contractor's "Acceptance Report" dated July 91.

Prof. Abouleid asked Dr.Sembenelli to introduce the Contractor's report.

The Closure Dam Acceptance Report

Dr. Sembenelli recalled that two previous meetings had been held on this subject and that matters arising from these discussions had been incorporated in this final report.

Dr. Sembenelli described the features of the proposed modifications to the Tender solution which were designed to take into account the characteristics of the available material.

The principle feature of the proposed solution is the replacement of the hydraulically placed and vibroflotated sand in the central zone of the dam with alluvial material from El Deir scalped at 100mm. Other recommended modifications are summarised as follows:

- The stream cutting dike to be constructed of 50-100mm rockfill excluding blasted or crushed rock. (The suitability of this material has been verified in the model tests)

- Over the 10m Centre Dense Zone, the scalped material from El Deir to be supplemented with a further 10 % of the natural fines fraction of the El Deir material (ie. passing 5 mm sieve) in order to reduce segregation in the vicinity of the cut off.

- The upstream portion of the closure dam to be built by placing hydraulic fill to slopes which have been determined on the basis of results of large scale tests carried out in the Left Bank spoil area.

- An increase in the weight of geotextile under and on the upstream face of the stream cutting dike. The recommended thickness under the dike would be dependent upon the method of placing the rockfill, but 1200gm/m2 is recommended on the upstream slope.

With respect to the weight of geotextile to be used under the rockfill, Dr. Sembenelli indicated that 1200 gm/m2 would be required if the protection material is to be dropped from barges but could be reduced to 800 gm/m2 if the rockfill is to be placed by grab. In any event he would not recommend the use of a membrane lighter than 800 gm/m2.

Dr. Sembenelli pointed out that an important feature of the Contractor's proposal is the elimination of the need for vibroflotation and hence the success of the construction of the Closure Dam would not be dependent upon the satisfactory densification of river sand by this method. The availability of suitable material is crucial to satisfactory vibroflotation and the Specification limits the fineness of the sand to be used (not more than 12% by weight to pass ASTM Sieve No. 200 when sampled at excavation). The Contractor therefore has taken into consideration the fact that approximately half of the samples of sand tested to date were found to be finer than required by the Specification and hence there are strong indications that it may be difficult to achieve satisfactory densification of river sand using vibroflotation.

In the discussion of the suitability of the river sand for vibrocompaction, the Cons RE referred to the fact that the geotechnical study carried out by Sogreah was preliminary and stated that the Sogreah Report was not a contract document. The Contractor was responsible for carrying out additional site investigation as part of the Contract. The Contractor stated that in his view the status of the Sogreah report was not relevant to this matter, however the necessary site investigation has been carried out.

The Tender Design

On behalf of the Design Consultants, Mr Lejeune described how the Tender design was developed, taking into account the requirement to use locally available material and the need to satisfy seismic requirements and to achieve a stable embankment. The designers therefore specified the use of hydraulically deposited sand fill material as they considered that the required densification could be achieved with vibroflotation.

Mr Lejeune pointed out that there was no evidence to suggest that the Tender solution as conceived by Sogreah and based on the soils data that was available at that stage could not be satisfactorily executed. However equally, in his view there was no evidence to suggest that the Contractor's proposal was not a workable solution. It was both desirable and proper that discussion should take place between the Engineer and the Contractor at this point in time so that any modifications or changes that would improve the project could be made.

Having examined the content of the Contractor's report, Mr Lejeune stated that in his view it was difficult to accept that the available sand has such a high silt content. In his opinion, samples taken from the spoil bank may not be representative of sand deposited on the river bed by the dredger as the operation of placing in spoil areas may result in higher retention of silt in the material.

Summary of Discussion

In response to Prof. Abouleid's request for clarification of the reasons underlying the Contractor's proposals, Dr. Sembenelli made the following points:

- If the central zone of the dam was to be constructed using hydraulically placed sand, it would be necessary to carry out trial tests in order to finalize the selection of equipment and determine the spacing of vibroprobes in order to achieve the required density.

- An important part of such testing is to establish correlation between achieved densities and CPT test results so that the effectiveness of the vibroflotation may be monitored as embankment construction proceeds. This is not always straightforward in view of the pattern of densification achieved by the vibroflotation process.

- In view of the nature of the tests required, it would not be practicable to carry out trial testing in advance of

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embankment construction. Trial tests would therefore have to be be carried out after a substantial proportion of the Closure Dam had been constructed.

- Depending upon the nature of the material being used, it may or may not be possible to exactly comply with the density requirements.

- The success of vibroflotation is dependent upon the properties of the material used and the success or otherwise of the tests would not be known until the tests had been carried out.

There is therefore an element of risk implicit in the decision to proceed with vibroflotation in that a substantial amount of dam construction has to be carried out before the test results are known.

In the unfortunate event that the test results indicated that it was not possible to comply with the specified requirements, it would be necessary either to accept a sub-standard solution or to rectify the matter by using an alternative method of construction. This would inevitably delay the Works as a whole and result in additional costs.

The Contractor stated that the intent of his solution was to eliminate the risk outlined above.

Mr Lejeune acknowledged that the optimisation of the vibroflotation system would take an indeterminate length of time and that some delay was possible, but considered that the length of any delay was unlikely to be as great as had been indicated by the Contractor.

The following points were discussed with Mr. Lejeune at the meeting and are subject to further serious discussion.

- The Stream Cutting Dyke is to be constructed with 50-100mm material. On a practical point, the Design Consultants indicated that it may be preferable to increase the quantity of 100-200mm material stockpiled for the closure in order to provide for a 60m length of dyke construction.

- There is no objection to the elimination of the T2 transition layer material under the dyke, provided heavy gauge geotextile is used.

- Irrespective of the above consideration, geotextile, of minimum weight 800gm/m2, is to be used for river bed protection.

- There is no objection in principle to the use of the scalped El Deir material for the Centre Dense Zone, in the event that the Contractor's solution is adopted.

- Sogreah requests that in case of adoption of the alternative, detailed stability calculations including pore pressure generation under earthquake in the foundation and the dam body be performed.

- A protection layer of pit run gravel over the upstream sand zone of the alternative is requested.

Prof. Abouleid stated that before reaching a decision on the outstanding matters, further samples of the river sand were required and therefore the Contractor was requested, as confirmed by the Cons RE, to carry out additional sampling in the area that would be dredged if the sand fill material were to be used. 50 samples were requested from five boreholes, which would be drilled in Sub Area 2.1.

In response to the request to provide the cost of his solution and the necessary time for execution, the Contractor indicated that he would prepare this assessment. This work will go ahead at the same time as the site investigation work with the objective that all necessary information will be available for discussion at a further meeting to be held in approximately one month's time.

IGL - COG J.V	SOGREAH	EDIPCO
		Mah. Abd Elmegued

170991.xtx
17.09.91

مرفق رقم (٦)

NEW ESNA BARRAGE AND POWER PROJECT

MINUTES OF MEETING HELD AT CAIRO UNIVERSITY ON 4 NOVEMBER'91

In Attendance :

MPW & WR	:	Eng. Abdel Hamid (Project RE.)
EDIPCO	:	Eng. Abdel Meguid (Consultant RE.)
	:	Eng. Kamel Rizk
	:	Prof. Abouleid (Special Consultant)
	:	Dr. Mamalouk
SOGREAH	:	Mr. Lejeune
	:	Mr. Monclar
IGL - COG. J.V	:	Mr. Caldani
	:	Mr. Labigalini
	:	Mr. Robinson
	:	Dr. Sembenelli (Special Consultant)
	:	Dr. Hamza (Special Consultant)
	:	Dr. Memon (ELC)

Professor Abouleid welcomed all present to the meeting, the purpose of which was to determine the optimum solution for the Closure Dam. Prof. Abouleid reminded those present that this meeting was being held further to the meeting on 17 September 1991 and he hoped that a good technical solution for the project would be defined.

The Minutes of the Meeting on 17 September were discussed. The Consultant RE requested some deletions and Mr. Lejeune requested some additions. The Minutes of Meeting were revised accordingly and signed to record agreement of the concerned parties.

Prof. Abouleid then invited Dr. Sembenelli to advise on the results of the supplementary site investigation. Dr. Sembenelli summarised the position as follows :

There is a marked difference between upper and lower sands and the upper sand is not uniform so that there are changes in the grading throughout the area under consideration. Initially it was not possible to detect such minor changes in the grading of the sand.

The Tender design concept was that Nile river sand would be utilised for construction of the Closure Dam on the assumption that it would be suitable for densification by vibroflotation.

As material was excavated during the course of construction, more information on the characteristics of the Nile river sand became available. The first such information was obtained while dredging the area downstream of the cofferdam and placing this sand in the Left Bank spoil area. While this operation was in progress, a visual inspection of the outlet pipe showed that the colour of the water jet was mostly dark and only whiteish for very short periods of time, indicating that the waterborne material was generally dirty (silt loaded). Gradings carried out on specimens recovered through SPT soundings performed in the spoil bank showed a rather high percentage of fines.

Sampling and gradings inside the cofferdam indicated that the material in this area was cleaner than the material in the spoil bank but still rather fine.

All such information was compiled and presented in the report on Foundation and Construction Materials submitted earlier this year. Subsequently in the Closure Dam Acceptance Report (July 1991) concern was expressed over the presence of these fine materials. As a consequence of these findings the Contractor's Consultant looked into the possibility of modifying the Closure Dam cross sections.

At the meeting held on 17 September 1991 it was considered advisable to obtain some further information on the materials that were actually available for constructing the Closure Dam. An instruction to obtain representative data by continuous sampling was carried out over the entire depth of several boreholes in the area that would be dredged upstream from the Closure Dam, (Area 2.1). The grading of this material was consistent with the material in the spoil area and approximately half of it contained a percentage of fines that exceeded the specified limit. The higher the percentage of fines the more difficult it is to achieve effective vibroflotation. A 20 % silt content combined with the uniformity of this sand would make vibrocompaction impossible.

Literature provides many examples of difficulties encountered when attempting to densify such materials by vibroflotation. There is also the possibility that even though proper treatment has been carried out, some checks will prove unsatisfactory. This will require difficult decisions to be made by the Engineer on the spot.

The Consultant's duty is to call attention to the limitations of the materials actually encountered and to the fact that their densification by vibroflotation will be difficult. There is a real probability that this process would not be successful on the Esna Closure Dam.

Dr. Sembenelli recalled that it is also a fact that quality control in such conditions is not straight forward as sounding methods, to validate the quality of construction, are affected by procedures, disturbances and time elapsed, as the rate of strength increase is an unknown and the appropriate timing of testing is difficult to predict. A given penetration profile cannot be duplicated and this will lead to contradictory results.

Prof. Abouleid asked Dr. Sembenelli whether he knew a project where vibroflotation had been successfully carried out in materials similar to those in hand and the reply was negative.

Prof. Abouleid then asked whether Dr. Sembenelli was against vibroflotation in principle as a means of densification. Dr. Sembenelli replied that vibroflotation was an excellent method but of limited applicability. Some sands were suitable for this method but not those available for the Closure Dam.

Prof. Abouleid queried whether, in the event of the material being suitable, SPT and CPT would be used to check the quality of the work. Dr. Sembenelli replied that SPT and CPT soundings are still by far the most widely used methods of control. However a statistical approach should properly be used in interpreting the results.

Dr. Sembenelli pointed out that in similar works a "method specification", suitably calibrated, is actually preferable to a "performance specification".

At this point in the proceedings Prof. Abouleid summarised what he had heard from Dr. Sembenelli as follows :

1) The soil in the field is not suitable for vibroflotation technology.

2) It is particularly important to take the actual properties of the material into account before embarking in a process which may not produce a satisfactory end result.

3) It will not be possible to assess the performance of vibroflotation in the available materials until a substantial volume of dredging, filling and densification has been completed.

4) It may be difficult to satisfy the Engineer / Employer that the densification achieved is sufficient, bearing in mind the problems associated with testing.

In response to a query on the the best way to proceed with testing Dr. Sembenelli answered that, in accordance with good engineering practice a "trial test" had been asked for in the Contract documents. Many important components of the densification method shall be defined through such test, such as: type of probe, pattern and spacing of the treatment points, velocity of probe withdrawal, power consumption limit, nature and grading of refill material. Engineering judgement is required to interpret these results and if necessary revise the Specification accordingly.

At this point Dr. Hamza made the following remarks :

1) The criterion for suitability of the materials should take into account shape and steepness of the grading curve as well as the percentage of silty fines.

2) The principle difference between the Contractor's proposal and the Tender design is a change in material in the centre zone of the dam, but the overall structure is essentially unchanged. However the modified structure as proposed by the Contractor relies on inherently good materials which require a minimum amount of improvement instead of a weaker material which would require substantially more improvement work.

3) It is a fact that the more improvement work that is needed the more extensive must be the associated testing to ensure that the end result is indeed satisfactory.

Prof. Abouleid then invited Mr. Lejeune to express his views.

Mr. Lejeune made the following three points :

1. The latest investigation disclosed a larger percentage of fines than anticipated in the first ELC soil report. I will say that the results of the latest investigation are worse than I expected but better than those for the spoil bank.

   Mr. Lejeune tabled Cumulative Frequency Curves which were based on data presented in the Addendum for the Closure Dam Acceptance Report. These curves showed that only 43% of the samples of river sand are within the limits set out in the Specification of the Contract and 85% of the samples contained less than 20% fines. It is known from International technical literature that above

20 % fine content vibroflotation is not effective. In the French recommendations for ground improvement, the maximum fine content of the sands for which the vibroflotation treatment to recommended is 17%. Beyond this value, the teatment progressively evolves towards stone columns. (A copy of the French recommendations was tabled during the meeting.) The latest grading results show that the material is on the border line of acceptable results for vibroflotation even if during placement some fines are lost.

The required densification process will be vibro - replacement leading to the creation of stone columns rather than a uniformly vibro - compacted material.

2. The Specifications were written in 1986 and represent a conservative approach to the maximum allowable level of silty fines and taking this into consideration a test section was included in the Contract requirements. Mr. Lejeune added that it is the prerogative of the Engineer to relax the limitations on the fines content of the material. However, owing to the grading of the sands the treatment will probably be a combination of vibroflotation and stone columns.

3. As far as quality control is concerned, Mr. Lejune entirely agreed with the comments of Dr. Sembenelli and added that sometimes it was difficult to prove that the required improvement had been achieved. Experience on the El Jebba dam in Nigeria was quoted where in sands that are cleaner and coarser than those experienced at Esna, the SPT blow counts after densification were less than those obtained before densification and increased only with time. The Contract Specification called for density testing 7 days and 30 days after vibroflotation, thereby introducing uncertainly in the quality control process. In there circumstances it may prove difficult for the Engineer to properly instruct the Contractor.

When asked by Prof. Abouleid to indicate the likely effect of time on the SPT and CPT results, Mr. Lejeune mentioned again the results obtained at Jebba. These results showed that in some instances the penetration resistance doubled with time, but in some instances it remained unchanged.

Referring to the possibility of not meeting the specified requirements (Sub-Standard), Mr Lejeune stated that it would be feasible to revise the Specification provided a check calculation is made to prove that the influence of such change would be acceptable in terms of stability , but, the fact remains that we cannot be 100 % confident in vibroflotation.

Prof. Abouleid commented that he understood that Mr. Lejeune had reservations about the suitability of vibroflotation in the type of material that had now been identified. Mr. Lejeune stated that densification in this material would result in the creation of stone columns throughout the embankment. This would increase the necessary construction time which may produce unsatisfactory contractual consequences. Mr. Lejeune added that there was a possibility that mud pockets would be formed in the fill.

Mr. Lejeune considered that when placing the dredged material in open water, some loss of fines (possibly up to 5%) could take place. At this point, Dr. Hamza pointed out that the dredged material will be placed in a relatively confined body of water. Dr. Hamza also recalled that no de-floculating agent had been used in carrying out the sieve analysis which may have lowered the percentage of silty fines present in the material, as measured in the tests.

Prof. Abouleid expressed his position, stating that he had the impression that the soil in the field lies on the borderline for successful vibroflotation. Even assuming that fully adequate material was available, the result of vibroflotation was not guaranteed throughout the entire mass. Also the controls are not 100 % reliable.

Prof. Abouleid stated that the Employer requires a perfect dam and an uncompromised margin of safety rather than a border line solution.

At this point Dr. Sembenelli stated that in this respect, the modified cross section for the Closure Dam represented a superior and safer solution for the Employer.

Mr. Lejeune stated that to achieve a perfect vibroflotation clean sands were required. Based on the Esna data, he was not sure that this could be done. On the contrary it could prove extremely difficult.

Mr. Lejeune added that from a technical viewpoint he had no objection to the solution proposed by the Contractor provided that certain stability analysis, including pore pressure generation during earthquake, was carried out. On this latter point he clarified that sophisticated analysis, as presented for the Power House and Spillway, was not needed. Mr. Lejeune expressed the view that the Contractor's design is a technically suitable solution.

Prof. Abouleid queried whether it was feasible to select a particular quality of material that would be suitable for use in the Closure Dam. The Project RE added that there may be more suitable material downstream of the cofferdam near the centre of the river.

Dr. Sembenelli stated that dredging was not a precise operation in the sense that the material cannot be selected as the dredger is working "blind". Furthermore the material towards the middle of the river tends to be fine.

The Prof. RE and the Cons RE stated that material from Areas 1.1 to 1.5 may provide better material and Prof. Abouleid asked the Contractor to clarify this point. The Contractor stated that in fact there are no other suitable areas except the downstream Area 2.2, where approximately 150,000 m3 is available. The other Areas 1.1, 1.2 & 1.3 have already been dredged and 1.4 and 1.5 are partially dredged, but in any case all of these areas are to be completed prior to construction of the Closure Dam to allow a) Navigation and b) Flow through the Spillway.

Prof. Abouleid asked Dr. Sembenelli to define a clean sand and the fineness of a sand that would be suitable for vibroflotation. In response Dr. Sembenelli stated that clean sand did not contain silt, i.e silt content less than 1%. Effective vibroflotation becomes more difficult as the fines increase, but this increase in difficulty is disproportionately larger than the increase in percentage fines. 2 to 3% fines would be a reasonable average percentage to aim for, but this could be increased to a maximum of the order of 5%.

Professor Abouleid stated that it seemed that Dr. Sembenelli prefers to modify the Tender solution in order to achieve a 100% satisfactory result in view of the nature of available materials. Prof. Abouleid asked Mr. Lejeune whether he agreed with this view and whether the Contractor's proposal using pit run gravel was worth considering in these circumstances. Mr. Lejeune agreed with this view and confirmed that, as he had stated at the previous meeting, he thought that the revisions proposed by the Contractor were reasonable. Mr. Lejeune added that one of the purposes of vibroflotation in the Tender concept had been to prevent collapse of material during excavation of the diaphragm wall, i.e to facilitate diaphragm wall excavation.

However, the Contractor stated that the proposed solution included measures to prevent this taking place.

On the matter of costs the Cons. RE referred to the Contractor's letter no. ED/E/678/91 dated 19/10/91 and queried the meaning of the words 'actual costs' and also queried the requirement to compensate the sub-contractor for deletion of vibroflotation. The Contractor clarified that actual costs meant the direct costs that could be demonstrated plus the contractual overhead. The Contractor also explained that the sub-contractor was required to

recover his overheads on approximately half the quantity of work foreseen and it would be necessary to compensate the sub-contractor for this loss.

Traffic in El Deir Village was also mentioned by the Cons. RE. who asked the Contractor why this subject was included. The Contractor pointed out that this had only been included for completeness as it may be necessary for the Employer to deal with any related matters arising from the villagers.

The meeting was adjourned for twenty minutes to allow this matter to be discussed between the Employer, the Engineer and his Consultants. When the meeting was reconvened the Contractor was handed a prepared statement which it was proposed to include as part of the agreed Minutes of Meeting.

The statement was as follows :

> "After this in depth discussion of the geotechnical information now available, the Tender solution is considered as remaining feasible, but that some difficulties might arise during the implementation of the vibroflotation of the hydraulic fill. The modified solution proposed by the Contractor looks to be technically acceptable in its main option, some additional design checks as required remain to be done.
>
> In terms of costs submitted by the Contractor's letter 678/91 dated 19/10/91, this will be settled within two weeks between Employer/Engineer/Contractor, putting in mind that the final cost of the new solution should be for actual work and should be within the total cost of the Contract solution.
>
> The acceptance of the Contractor's solution is bound by the final cost agreement.
>
> The Contractor is not entitled for any claims concerning the design or the execution."

The Contractor stated that in his view, the conclusion of the meeting, which had previously been stated as being the final technical meeting in this matter, should be a technical decision based on the points that had been agreed in the previous discussion. Furthermore the agreement of rates and prices is a matter which is more appropriately handled by separate discussion between the concerned parties.

The Contractor rejected the above statement as it was completely contradictory to the statements that had previously been made at the meeting and the contents of his letter reference ED/E/678/91 dated 19.10.91. The Contractor

was not prepared to signify agreement with this proposed joint statement as a pre-condition to proceeding with his proposed solution.

However, the Contractor commented that he was pleased that the Employer and Engineer were ready to agree and finalise all the rates and prices involved in a 15 day period.

It was agreed that the 15 days period for discussion of the financial aspects of the Contractor's solution would commence with a meeting am. on Saturday 9 November.

M.P.W & W.R	E D I P C O
S O G R E A H	IGL - COG J.V

041191/kotb
19.12.91

Date : 19.10.91, Esna
Reference : ED/E/ 678 / 91
مرفق رقم (٦)

To : Edipco
Cairo

Subject : Civil Works : Closure Dam

Dear Sirs

The matter of the detailed design of the Closure Dam has been under discussion for some time and it is necessary to finalise this matter without delay. In view of the importance of the Closure Dam to the satisfactory and timely execution of the Project, we have obtained the services of a Specialist Consultant in this field to supplement the work of our Design Consultants. The necessary data is available to enable a decision to be made.

We have developed a solution for the Closure Dam which takes into account the nature of the sand actually encountered at the site and has certain advantages to the Employer in terms of:

- Safety and quality of construction
- Cost savings resulting from the elimination of vibroflotation
- Costs and time for construction are known prior to start of construction as the unknown costs and time requirement associated with vibroflotation are not applicable.

Furthermore, taking into account the criticality of the Closure Dam and in view of the now known characteristics of the available Nile river sand, we have to inform you that we are not able to accept responsibility for the execution and the detailed design of the Works unless appropriate revision to the Tender design is made.

Reference is made to the following documents:

- Closure Dam Acceptance Report dated July 1991
- Minutes of Meeting held on 17 September at Cairo University
- Addendum to Closure Dam Acceptance Report dated October 1991 and attached
- Letter reference ED/E/677/91 dated 19.10.91 with Dr. Sembenelli's and our response to Comment No. 84 of Dr. Abouleid
- Schedule of Prices attached to this letter

We wish to elaborate this matter as follows:

1. Introduction

The Tender design concept for the Closure Dam was to form the embankment from the Nile river bed up to Elevation 75.0m using hydraulic sand filling. The Contract makes provision for the densification of this material by vibroflotation.

Successful densification of fill material by vibroflotation is to a large extent dependant on the nature of the material. Thus coarse granular materials will produce satisfactory results, but very fine and silty materials are not suitable.

Site investigations carried out prior to Tender provided soils information for preparation of the Tender documents. However this information was considered incomplete and the Contract makes provision for further site investigation to obtain the additional information required for the detailed design. Data from this further site investigation is now available.

2. The Requirements of the Specification

The proportion of fines in the material to be used in the embankment of the dam is limited by the following clauses in the Specification:

Clause 5.8.2 states:

-"For the hydraulic sand filling, dispositions of Cl. 5.3.2.2 are to be followed."

Clause 5.3.2.2b) states:

-"Material specification for hydraulic filling of the closure dam is given in Section 5.3.5.2a).

Furthermore Clause 5.3.2.2d) and g) stress the requirement to prevent the "small proportion of fines present in the material" from collecting into mud pockets either in fill areas or in temporary stock piles.

Clause 5.3.5.2a) states:

-"For the hydraulically deposited sands of the closure dam or any other hydraulically deposited sand, the percentage in weight passing ASTM sieve No. 200 measured at the excavation or borrow area location will be less than 12%." ie. in the range 0 - 12%.

3. Actual Properties of Nile River Sand

Current soils data shows that the Nile river sand available for the hydraulic sand filling is rather fine and at the limit of acceptability for satisfactory vibroflotation. In fact, approximately half of the samples providing data for the 'Closure Dam Acceptance Report' and the 'Addendum' to this report would fail to comply with the requirements of the Specification. Hence some relaxation of the Specification would be required if the Nile river sand were to be used.

4. Summary of the Contractor's Position

Taking into account the known properties of the Nile river sand, namely that the 'fine-ness' of the sand is generally only just within or even outside the limits defined in the Specification, the Contractor has proposed the use of alternative materials and zoning which in his view would result in a superior solution for the Closure Dam in terms of safety and quality of construction.

The Contractor proposes, inter alia, that the centre dense zone be constructed with pit run sand and gravel from El Deir in lieu of the river sand. This alternative denser type of material does not require additional densification by vibroflotation and hence cuts out any uncertainty associated with this process. In the Contractor's view it would be inadvisable to proceed with the construction of the Closure Dam utilising the available river sand.

Furthermore in view of the known characteristics of the river sand the Contractor has to take into consideration his own responsibilities in respect of the detailed design and construction of the Works. In these circumstances, the Contractor considers that he could not be held responsible for the detailed design in accordance with the Tender design or for the execution of such Works at the present Contract rates and prices. In addition, the Contractor could not be held responsible for any additional costs or increased time requirement that may be incurred.

5. Cost Implications

The attached Schedule of Prices for the construction of the Closure Dam has been prepared in accordance with the Contractor's proposals.

- Contract rates have been used as extensively as possible.

- Where 'new' items and rates are proposed, these are based on actual costs.

- The implementation of the proposed solution will result in a small increase in the value of imported items. It has therefore been assumed that all Customs Duties and Taxes in respect of this increased value will be paid by the Employer and that the 'ceiling' quoted in Article 26 of the Contract Agreement will be adjusted accordingly.

- In accordance with the Contract, the Contractor was obliged to obtain the services of a specialist sub contractor to perform the vibroflotation work. As this work would be deleted, the sub contractor has indicated that he will require reimbursement of all losses associated with the deletion of these works. Provision for this deletion has been made in the Schedule of Prices.

The Schedule also includes BOQ items, rates and prices from the Contract which are applicable to the Tender design. However, it must be emphasised that the price of the Contractor's proposal cannot be compared directly with the overall Tender price for the Closure Dam in view of the uncertainty over the amount of vibroflotation required and the time necessary for its execution.

It is difficult to predict the amount of vibroflotation that would have to be carried out in the river sand to completely satisfy the density requirements set out in the Specification. In practice it may not even be feasible to achieve the precise density required and a further difficulty is that density increase is not immediate. The Contractor may therefore have to carry out larger quantities of vibroflotation and in more difficult conditions than originally envisaged. There is therefore a risk that the actual cost of vibroflotation would exceed the amount included in the BOQ. An assessment of these risks has been included in the Schedule of Prices.

The Contractor will not claim any costs in addition to those listed in the Schedule of Prices and agreed with the Engineer/Employer as a consequence of the adoption of his solution for the Closure Dam.

6. Effect on the Contract Period

The construction of the Closure Dam in accordance with the Contractor's proposals will not either extend or reduce the overall construction time necessary to complete the Works. However, the discussion of the final design for the Closure Dam has been ongoing for some months now and it is necessary to conclude this matter without delay. It is also necessary to ensure that delays are not caused by the following matters:

- Certification and Payment. Agreement in principle has to be reached as to the method of certification and payment to be applied to these works.

- Processing of materials. The Contractor originally planned to commence production of the El-Deir material at the beginning of this month. This start has been delayed but production must start at the beginning of November to allow preparatory work on the dam to commence at the beginning of December this year.

- Procurement of geotextile. Sufficient time has to be allowed for the approval and procurement of the materials to be used.

- Traffic in El Deir village. The use of material from El Deir would inevitably increase the volume of traffic through the village, which may cause inconvenience to residents during the construction period. It has been assumed that the Employer will provide any necessary assistance in this matter.

In addition to the risks of increased costs of vibroflotation set out in Para. 5, there is also the related risk that an increased time for execution may be required for this work.

Providing that timely agreement is reached and timely instructions are issued, the Contractor will not request any Extension of Time in respect of this solution for the Closure Dam.

In summary and taking the critical nature of the Closure Dam into account, we consider that there are good and justifiable reasons for proceeding with the Contractor's Solution. If the risks associated with vibroflotation were to become reality, the completion of the whole project would be seriously affected. Additional time for completion would be required and additional financing facilities would have to be found to cover the additional costs involved. These risks are avoidable.

We trust that we have covered all the points necessary for you to reach an early decision in this matter and we are at your disposal for any clarification that you may require.

Yours faithfully

EUROCEB

European Consortium For Esna Barrage

1444
21.10.91

Eng. PIER LUIGI CALDANI
Project Manager

EDIPCO CAIRO	3 COPIES
MPW & WR ESNA	2 COPIES
EDIPCO ESNA	1 COPY

A BARRAGE CLOSURE DAM - SCHEDULE OF PRICES

ESNA 19-10-1991 FILE NAME : CLOSDAM.WK1

ITEM DESCRIPTION		TENDER DESIGN					CONTRACTOR'S SOLUTION				
		EP			UD		EP			UD	
		QUANTITY	RATE	AMOUNT	RATE	AMOUNT	QUANTITY	RATE	AMOUNT	RATE	AMOUNT
ONAL CONSULTANCY FEES	LS					150,000					150,000
PHRAGM EXCAVATION	m2	23,524.00	20.0536	471,746	38.7648	911,903					
PHRAGM EXCAVATION IN COMPACTED GRAVEL	m2						23,524.00	20.9281	492,313	42.6863	1,004,153
PHRAGM EXCAVATION IN HARD CLAY	m2	1,330.00	20.9287	27,83[illegible]	42.6863	56,773	1,330.00	20.9287	27,835	42.6863	56,773
ER FOR REVISED CONSTRUCTION METHOD	m2						24,854.00	3.9657	98,564	10.8156	265,811
LES AND GROUT FILLING	LS								100,000		200,000
HRAGM PLASTIC CONCRETE	m3	19,883.00	53.7011	1,067,73[illegible]	14.4363	287,037	19,883.00	53.7011	1,067,739	14.4363	287,037
R EXECUTION	m2						19,883.00	8.0552	203,415	2.1654	43,055
RAGM CONCRETING UNDER BENT.	m3	19,883.00	3.3892	67,38[illegible]	7.8434	155,950	19,883.00	3.3892	67,387	7.8434	155,950
R EXECUTION	m2						19,883.00	0.5084	10,109	1.1765	23,392
TOTAL WORKS				7,480,80[illegible]		6,294,957			7,167,534		5,157,469
COMPENSATION											
T S.B SUBCONTRACTOR FOR VIBROFLOTATION	LS										-1,700,000
OTAL COMPENSATION				NIL		NIL			NIL		-1,700,000
ION OF POTENTIAL RISKS:											
COSTS OF VIBROFLOTATION IN FINE MATERIAL E INCREASE IN QUANTITIES	LS					1,021,000					
DITIONAL COST OF EXTENTION OF P.D.W. IALS COLLAPSE WITHIN TRENCH	LS					190,000					

THE ENGINEER

Consortium For New Esna Barrage And Power Project

EDIPCO E.P.S SOGREAH

DATE : ESNA, 16/12/1991
OUR REF. : 1076/ 91

مرفق رقم (٨)

TO : EUROCEB /ESNA

SUBJECT : CIVIL WORKS : THE CONTRACTOR'S ALTERNATIVE SOLUTION FOR THE CLOSURE DAM

Dear Sirs,

In respect of the above subject we refer to the following correspondences and minutes of meetings :- .

Your letters No. ED / E / 679/90, 678/91, 679/91, 718/91, 753/91, 780/91 dated 20/10/1990, 19/10/91 , 21/10/91, 07/11/91, 24/11/91 and 1/12/91, the minutes of meetings held at Cairo University on 17/09/1991 & 04/11/91, the minutes of meetings held at Esna on 09/11/1991, 13 & 14/11/91 the meeting discussions occured after in EDIPCO CAIRO office on 05/12/1991 and the successive meeting discussions occured after that in Esna, the latest of which is on 16/12/1991 .

And you are reminded and furnished with the following statement minuted in the meeting held at Cairo University on 04 / 11 / 1991- quote " After this in depth discussions of the geotechnical information now avalilable , the tender solution is considered as remaining feasible,but that some difficulties might arises during the implementation of the vibro-flotation of the hydraulic fill . The modified solution proposed by the Contractor looks to be technically acceptable in its main option, some additional design checks as required remain to be done " .

In terms of costs submitted by the contractor's letter 678/91 dated 19/10/1991 this will be settled within two weeks between Employer/Engineer / Contractor , putting in mind that the final cost of the new solution should be for actual work and should be within the total cost of the Contract solution .

Mok

The acceptance of the contractor's solution is bound by the final cost agreement .

The Contractor is not entitled for any claims concerning the design or the execution ." unquote.

Also we refer you to the results of the 8 boreholes requested by the Project Resident Engineer which has been submitted by your letter No. ED / E / 766 / 91 dated 27/11/1991 and it shows that a considerable quantity of sand has a percentage of fines less than 12 %

In the light of the above mentioned we see that both of the tender design and your alternative solution for the closure dam are feasible and could be executed and as you are responsible for the design and the exceution according to the conditions of the Contract you are free to choose the solution which is more suitable for you from execution point of you .

In case you choose the alternative design prepared by you, we have no objection to accept it according to the rates, quantities , amounts which have been discussed with you and the Project Resident Engineer in several meetings starting from 09/11/1991 till the last meeting on 16/12/91.

All the items of the closure dam as scheduled in the last list submitted by you on 16/12/1991 are accepted except the following items :-

(1) The value of 26,118.0 $ for ISMC - Italy - laboratory testing is not accepted, please refer to EDIPCO CAIRO letter ED/C/146/90 dated 20/10/1990 which states to you that any extra investigations or studies shall be at your expense .

(2) The cost of 110,000. $ doller for additional consulting fees included in the schedule of rates submitted by you on 09/12/1991 is not accepted too, please refer to EDIPCO CAIRO letter No. ED / C / 146 / 90 dated 29/10/1990 in reply to your letter No. ED / E / 679 / 90 dated 20/10/90 the second paragraph of which reads " one of the items that Mr. Sembenalli has been addressed and will follow up in the future,

in collaboration with ELC, is the design of the closure dam. as foreseen in the technical specification clause 5.8.1 the tender solution has been duly considered and also possible alternative have been examined in the light of all information provided by the tender documents as well as of the additional data and experience gained during the early part of the construction activities "

The chairman of EDIPCO via his letter mentioned above in reply to your letter No. ED / E / 679 / 90 dated 20 / 10 / 1990, has stated and you have been notified that any extra investigation or studies shall be at your expensse so far the alternative design has been initiated and proposed by you.

Moreover you haven't got the approval of the Engineer or the Employer on this additional fees before commiting yourself with Mr. Sambeneli .

(3) Compensation for subcontractor

In the schedule of prices submitted by you for the cost of your alternative design, you requested the payment of $ 1.7 million againest the compensation for vibroflotation subcontractor specialist without giving any details in terms of :-

- Full description of the job .
- The volume and cost of work assaigned to specialist and its percentage to the total cost of the contract .
- The analysis and break down of the compensation .
- The percentage of the compensation related to the cost of the deleted work .
- Documents, clauses of the contract justifying your claim .

In additional to that you forget that in the geotechnical investigation main report(October 1989) it is stated that it is worthwhile mentioning that the site of the New Esna Barrage and Power Plant has been already investigated through two different campaigns, first

ending in 1984 and the second ending 1986. Another investigation campaign started in March 89 and was completed at the end of Sept. 1989 to define foundations soils characteristics in order to make the final decision for the soil treatements and foundations.

The Contractor should not have made any final commitment with the subcontractor concerning the vibroflotation of the closure dam before getting the results of geotechnical investigation specified in the contract.

So, for the aforementioned reasons, we don't accept allowing any payment as a compensation to the specialised subcontractor for vibroflotation deletion., and we inform you that this claim is rejected.

As a result of the above mentioned the total cost of your alternative design will be :-

E.P 6.445 346 million US $ 4.195 470 million

.The cost of the rejected items are as following :-

a)- Laboratory test performed in Italy = 26,118.$

b)- Additional consulting fees =110,000.$

c)- Claim of the subcontractor = 1,70. mill. $

<u>The items whose rates are accepted provisionally</u>

a)- The two items of the unwoven geotextile: 1200 grm. & 800 grm. are provisionally accepted subject to the submition of the importing documents.

b)- The two items of the Drill holes & the grout filling of the holes are accepted provisionally until submitting the lowest offer of the subcontractor.

c)- The four items of the revised construction method of the P.D.W. in a distance of 200 m, these rates are accepted but its execution is subject to the approval of EDIPCO special consultant for the revised method of the P.D.W. from 7.5 m panel to 3.0 m panel, and the overlapping between the primary panel & the secondary panel is .75m.

d)- The rate of the double handling will be applied on the quantities of the pit rungravel which will be stockpiled on the right bank and to be used under water only the quantity which will be dumped directly will be not be included under this item .

Concerning your statement about the customs duties in your letter ED / E / 678 / 91 dated 19 / 10 / 1991 it is agreed that the customs duties on the unwoven geotextile will be paid by the Employer and that the ceiling quoted in article 26 of the Contract agreement will be adjusted accordingly .

Concerning your statement about the traffic in EL-DEIR village this is your own responsibility , the Employer may assist you on this matter but without any commitment of increase of time or any financial claim relating to this subject .

Concerning your statement about the certification and payment, please be informed that this will be according to the conditions of the contract & the Contract agreement .

At last you are kindly requested to confirm your acceptance of the design which you prefer and in case you choose the alternative design proposed by you, your acceptance on the rates, quantities and the cost of your design as stated above is also urgently requested in order to get the final approval of the Employer in writing to be able to issue the variation order to you for the alternative design according to item 51 & 52 of the conditions of the contract, after that you can start submitting the design and detailed drawing for checking and final approval .

The early response from your side will be appreciated .

Thank you .

Yours Faithfully

Moh. Abd Elmeguid 16/12/91

Eng. Moh. Abdel Meguid Osman
Consultant, Resident Engineer

Copy to : MPW & WR / ESNA
Copy to : EDIPCO / CAIRO

ESNA BARRAGE CLOSURE DAM - SCHEDULE OF PRICES

ITEM DESCRIPTION		CONTRACTOR'S SOLUTION				
			EP			UD
		QUANTITY	RATE	AMOUNT	RATE	AMOUNT
1 4.203B EXC. OUTSIDE COFF. PLACED UNDER ELEV. 73.00	m3	100,000.00	--	--	--	--
2 4.223 PIT RUN GRAVEL (0-100) UNDER WATER	m3	192,300.00	3.7976	730,278	5.3159	1,022,248
3 4.222 PIT RUN GRAVEL (0-100) IN DRY	m3	142,550.00	3.1787	453,124	4.4302	631,525
4 NP EXTRA OVER FOR DOUBLE HANDLING	m3	192,300.00	0.2114	40,652	0.5988	115,148
5 5.210 COMPACTION AT 75% DF	m3	142,550.00	0.2440	34,782	0.2000	28,510
6 9.226 ROCK FILL DIKE +SCOUR PROTECTION	m3	82,300.00	22.9628	1,889,838	3.6522	300,576
7 N.P. RIP RAPC(50-100)AND SLOPE PROT. above 75.00	m3	26,100.00	15.2417	397,808	4.3670	113,979
8 4.1121 UNWOVEN 320 GR.SLOPE PROTECTION IN DRY	m2	27,500.00	1.3784	37,906	2.4349	66,960
9 NP UNWOVEN 1200 GR.UNDER WATER(SLOPE ROCKFILL)	m2	8,200.00	16.0340	131,479	9.0250	74,005
10 NP UNWOVEN 800 GR.UNDER WATER(UNDER SCOUR PROT.)	m2	22,300.00	15.8580	353,633	6.6020	147,225
11 11B 913 TRIAL AREA AND CONTROL TESTES	LS			38,696		73,695
12 NP ADDIT. GEOTECHNIC. INVESTIGATION AND LAB. TESTING (Excl. add. invest. areas 1.2,1.5,2.2)	LS			60,527		7,740
~~13 NP ADDITIONAL CONSULTANCY FEES~~	~~LS~~	Unaccepted				~~110,000~~
~~14 NP LAB.TESTING IN ITALY(110000+26118)~~	~~LS~~	Unaccepted				~~26,118~~
15 10.803 DIAPHRAGM EXCAV. IN SILT,SAND,GRAVEL,BOBBLE	m2	23,524.00	20.0538	471,746	38.7648	911,903
16 NP E.O. DIAPHRAGM EXCAVATION IN COMP. GRAVEL (450 m)	m2	6,850.00	0.8749	5,993	3.9215	26,862
17 10.804 DIAPHRAGM EXCAVATION IN HARD CLAY	m2	1,330.00	20.9287	27,835	42.6863	56,773
18 NP E.O FOR REVISED CONSTRUCTION METHOD IN SAND (200m)	m2	2,972.00	4.0108	11,920	7.7530	23,042
19 NP E.O. FOR REV. CONST. METHOD IN COMPACTED GRAVEL AND HARD CLAY (200m)	m2	5,378.00	4.1857	22,511	8.5373	45,914
20 NP DRILL HOLES (Provisional)	M	1,500.00	287.184	430,776	33.213	49,820
21 NP GROUT FILLING (Provisional)	m3	750.00	125.39	94,043	35.723	26,792
22 10.805 DIAPHRAGM PLASTIC CONCRETE	m3	19,883.00	53.7011	1,067,739	14.4363	287,037
23 NP EXTRA OVER EXECUTION (200 m)	m2	6,680.00	10.7402	71,745	2.8873	19,287
24 10.806 DIAPHRAGM CONCRETING UNDER BENT.	m3	19,853.00	3.3892	67,387	7.8434	155,950
25 NP EXTRA OVER EXECUTION (200 m)	m2	6,680.00	0.6778	4,528	1.5687	10,479
TOTAL WORKS				6,445,346		4,795,470 ~~4,331,58[illegible]~~
COMPENSATION						
~~26 TO SPECIALIST SUB SUBCONTRACTOR FOR VIBROFLOTATION - DELETION~~	~~LS~~	Unaccepted		10/12/91		~~1,700,000~~

EUROPEAN CONSORTIUM FOR ...

EUROCEB

EUROPEAN CONSORTIUM FOR ESNA BARRAGE

Impresit - Girola - Lodigiani

"IMPREGILO" S.P.A.

COGEFAR Costruzioni Generali S.P.A

Gruppo Industrie Elettromeccaniche per

Impianti all'Estero - G.I.E-S.P.A.

ROMENERGO State Enterprise for Foreign Trade

Date : 18.12.91, Esna
Reference : ED/E/ 825 / 91

مرفق رقم (٩)

To : Edipco
Esna

Subject : Civil Works : Closure Dam

Dear Sirs

We refer to your letter no. 1078/91 dated 17.12.91 in response to our letter no. 818/91 of the same date and respond to your request for a clarification as follows:

In the circumstances that:

- We tendered for the construction of the Closure Dam on the basis of the Specification, ie. using sandy material with a fines content in the range of 0 - 12% passing ASTM sieve no. 200.

- We are responsible for detailed design in accordance with the principles defined in the Specifications and Drawings prepared by Others and not simply for the design as you have suggested.

- We alerted the Engineer and the Employer of the fineness of the material actually encountered and available for construction and of the consequent design and construction implications.

- We produced the 'Closure Dam Acceptance Report' in July in accordance with the requirements of the Contract which identified a solution using a more robust material with long term advantages to the Employer.

- Two meetings were held in Cairo, during which our professional adviser drew attention to the disadvantages of vibroflotation in this material and your professional advisers confirmed the principle of these remarks.

- The Employer/Engineer's statement 'some difficulties might arise during the implementation of the hydraulic fill' is minuted.

- Revision of the foreseen working procedures would be required in the event that vibroflotation of these river sands were to be used.

- The consequences of the use of vibroflotated sand in terms of achievement of density, time requirement and hence additional costs are unknown. (We trust that the Employer is aware of the magnitude of these consequences)

- From July through to 16.12.91 we have not received any indication of the Employer's requirements in response to any of our letters concerning the Closure Dam.

- Notwithstanding the above, we have held many meetings with the Employer and the Engineer in order to agree rates and prices and we are pleased to note that the majority of these have now been agreed.

- This long outstanding matter has to be finalised.

We consider that it is a gross over-simplification to suggest that there are two equivalent options available and that we, alone, as Contractor, are responsible for making this decision.

Furthermore we think that the use of the word 'Alternative' is a mis-nomer.

However in response to the request for a clarification contained in your letter no. 1078/91 we confirm that as stated and in accordance with our letter no. 818/91 dated 17.12.91, we are proceeding on the basis of the solution described in the Closure Dam Acceptance Report.

Yours faithfully

EUROCEB
European Consortium For Esna Barrage

[signature]

Eng. PIER LUIGI CALDANI
Project Manager

1816
18.12.91

EDIPCO ESNA 3 COPIES
MPW & WR ESNA 2 COPIES
EDIPCO CAIRO 1 COPY

THE ENGINEER

Consortium For New Esna Barrage And Power Project

EDIPCO E.P.S SOGREAH

DATE : ESNA, 15/01/1992

OUR REF. : 56 /02

مرفق رقم (١٠)

TO : THE PROJECT RESIDENT ENGINEER
FOR NEW ESNA BARRAGE PROJECT
ESNA.

SUBJECT : THE CONTRACTOR (EUROCEB)
ALTERNATIVE SOLUTION OF CLOSURE DAM

Dear Sirs,

In this connection we refer to the conclusive statement of minutes of meeting held at cairo university on 4 November 1991 attended by the Employer, EDIPCO, SOGREAH and IGL - COG,J,V representatives quoted " After this in depth discussion of the geotechnical information now available , the tender solution is considered as remaining feasible, but that some difficulties might arises during the implementation of the vibroflotation of the hydralulic fill . The modified solution proposed by the contractor looks to be technically acceptable in its main option , some additional design checks as required remain to be done .

In terms of costs submitted by the contractor's letter 678/91 dated 19 / 10 / 1991, this will be settled between Employer / Engineer/ Contractor, putting in mind that the final cost of the new solution should be for actual work and should be within the total cost of the contract solution "

And in compliance with the comments and recommendations of those staff members, several meetings have followed held with EUROCEB staff attended by the Employer and Engineer (Yourself and myself) to settle the matter of cost being stated as aforementioned .

Mah

THE ENGINEER

Consortium For New Esna Barrage And Power Project

EDIPCO E.P.S SOGREAH

AS a result of our heavy discussions with the contractor, he submitted his schedule on 16 / 12 / 1991 as accepted by him , this list has been accepted by both of us too, except the following items which we confirmed our rejection to them to the contractor during our meetings and discussions.

Item 13 NP Additional Consultancy Fees .

Item 14 NP Laboratory Testing In ITALY

Item 26 To Specialist Subcontractor For Vibroflotation deletion .

These rejected items, items whose rates are accepted provisionally under some conditions and our comments on the contractor's statements of his letter NO. 678 / 91 dated 19 / 10 / 1991, have been transferred to EUROCEB via our letter No. 1076 / 91 dated 16 / 12/91 copy to you. In reply to that, EUROCEB sent their letter No. ED / E/825/ 91 , dated 17 / 12 / 1991 confirming that they are proceeding on the basis of their alternative solution .

In addition to that it is well known to you that the cost of the Tender design depends on the value of the vibroflotation which by turns depends upon the spacing of the vibroprobes of 2.0m , 2.4 m & 2.8 m as specified in item 11.7.2.4 of the Tech. specification .

The special consultant advised that the actual spacing will be the most probably of 2.0 m or may be less. So we calculated the cost of Tender design once on the basis of vibroflotation value having spacing of 2.4 m as a mean value between 2 & 2. 8 m and once on the basis of 2.0 m spacing as the least distance expected according to the fineness of sand filling which may be reaching 1.70 m as proposed by the contractor.

The cost evaluation of tender design according to 2.4 m and 2.0 m vibroflot spacing and the contractor alternative solution are listed in the attached three schedules resulting :-

Mel

Case A - Tender Solution making the vibroflotation at a spacing of 2.4 m .

EP 6 146 654.2 $ 3 976 169.2

Case B - Proposed Alternative Solution without vibroflotation

EP 6 445 346 $ 4 195 430

Case C - Tender solution making the vibroflotation at a spacing of 2.0 m .

EP 6 448 157.2 $ 4 549 179.2

Consequently it could be remarked that in case of applying the contractor solution (Case B) , the cost estimation will be extra over by EP 298 691.8 & $ 219 260.8 more than the Tender design vibroflotted at 2.4 m spacing (Case A) .

And it will be less by EP 2 811.2 and $ 353 749.2 than the Tender design vibroflotted at a spacing of 2.00 m .

Also it is worthy to make it clear that as a result of the intensive negotiations with the contractor, we were able to reduce his cost estimation of his alternative design submitted in his schedule of prices dated 19/10/91 attached to his letter No. ED/E/678/91 dated 19/10/91 from EP. 7 069 709 & $ 5 034 045 to EP. 6 445 346 & $ 4 195 430 with a decrease of EP. 624 363 & $ 838 615 .

Further to that the consultants SOGREAH and EDIPCO special consultant Dr. Abouleid have show in many different occasions (meetings and exchange of correspondences) that case C is the most probably applicable solution in case of considering Tender design because of the expected increase in the percentage ratio of material fineness which will be creating less spacing and consequently higher cost and more completion time over that of the contract period .

On the light & bases of the aforesaid explanations the special consultants have accepted the contractor Alternative Solution subject to additional design checks and as the financial evaluation proves that the cost of contractor alternative design ,

is less than the contract design and there will be no expected difficulties or delay in the execution of the alternative design , we feel that we are satisfied and convinced to recommend your approval in writing for the execution of the alternative design according to the rates and conditions stated to the contractor in our letter NO. 1076/91 dated 16 / 12 / 1991 .

As soon as we get your approval we will issue the necessary relevant variation order Please .

Yours Faithfully

Moh. Abd Elmeguid 15/1/92

Eng. Moh. Abdel Meguid Osman
Consultant, Resident Engineer

Copy to : EDIPCO - CAIRO

NEW ESNA BARRAGE CLOSURE DAM - SCHEDULE OF PRICES

CASE "A"

ITEM DESCRIPTION		QUANTITY	TENDER DESIGN E. P RATE	TENDER DESIGN E. P AMOUNT	TENDER DESIGN U RATE	TENDER DESIGN U AMOUNT
9.213 EMBANKMENT FROM STOCK PILES (IN DRY)	m3	160,000.00	0.6305	100,880.00	0.8137	130,192.00
9.210 EMPANKEMENT COMPACTION	m3	160,000.00	0.2474	39,584.00	0.2022	32,352.00
9.214 EMPANKM. MATERIAL FROM TEMPORARY STOCK PILES	m3	50,000.00	0.5901	29,505.00	0.7115	35,575.00
4.203B EXC. OUTSIDE COFF. PLACED UNDER ELEV. 73.00	m3	270,000.00		0.00		0.00
9.217 TRANSTION T2	m3	23,000.00	10.0288	230,662.40	13.8330	318,159.00
9.218 TRANSTION T3	m3	18,000.00	8.0947	145,704.60	2.0137	36,246.60
9.220 RIP RAP B(100-200)	m3	20,500.00	7.1470	146,513.50	2.3533	48,242.65
4.204 TRENCH EXCAVATION	m3	10,000.00	1.7032	17,032.00	1.4769	14,769.00
9.225 ROCK FILL DIKE +SCOUR PROTECTION	m3	130,000.00	22.9628	2,985,164.00	3.6522	474,786.00
5.1121 UNWOVEN FABRIC FILTER (CREST ROAD)	m2	14,000.00	0.3347	4,685.80	2.1586	30,220.20
5.1122 UNWOVEN 220 GR.	m2	56,000.00	2.3717	132,815.20	2.7071	151,597.60
11B 911 VIBROFLOT. < (2.4 m SPACING)	m	88,000.00	7.4747	657,773.60	14.2659	1,255,399.20
11B 912 VIBROFLOT. > 25m	m	0.00	0.0000	0.00	0.0000	0.00
11B 914 BACKFILL SAND	m3	7,000.00	0.6761	4,732.70	0.9940	6,950.10
11B 915 BACKFILL STON	m3	1,500.00	2.7917	4,187.55	3.9049	5,857.35
11B 913 TRIAL AREA AND CONTROL TESTES	LS			13,156.64		25,056.30
10.003 DIAPHRAGM EXCAVATION	m2	23,524.00	20.0538	471,745.59	38.7648	911,903
10.004 DIAPHRAGM EXCAVATION IN HARD CLAY	m2	1,330.00	20.9287	27,835.17	42.6863	56,773
10.005 DIAPHRAGM PLASTIC CONCRETE	m3	19,883.00	53.7011	1,067,738.97	14.4363	287,037
10.006 DIAPHRAGM CONCRETING UNDER BENT.	m3	19,883.00	3.3892	67,387.46	7.8434	155,950.32
TOTAL OF CONTRACT DESIGN				6,146,654.2		3,976,169.2

(C:\Q\TENDER.WQ1)

CASE "B"

ITEM DESCRIPTION		CONTRACTOR'S SOLUTION				
			EP		UD	
		QUANTITY	RATE	AMOUNT	RATE	AMOUNT
1 4.203B EXC. OUTSIDE COFF. PLACED UNDER ELEV. 73.00	m3	100,000.00	--	--	--	--
2 4.223 PIT RUN GRAVEL (0-100) UNDER WATER	m3	192,300.00	3.7976	730,278	5.3159	1,022,248
3 4.222 PIT RUN GRAVEL (0-100) IN DRY	m3	142,550.00	3.1787	453,124	4.4302	631,525
4 NP EXTRA OVER FOR DOUBLE HANDLING	m3	192,300.00	0.2114	40,652	0.5988	115,148
5 5.210 COMPACTION AT 75% DR	m3	142,550.00	0.2440	34,782	0.2000	28,510
6 9.226 ROCK FILL DIKE +SCOUR PROTECTION	m3	82,300.00	22.9628	1,889,838	3.6522	300,576
7 N.P. RIP RAPC(50-100)AND SLOPE PRDT. above 75.00	m3	26,100.00	15.2417	397,808	4.3670	113,979
8 4.1121 UNWOVEN 320 GR.SLOPE PROTECTION IN DRY	m2	27,500.00	1.3784	37,906	2.4349	66,960
9 NP UNWOVEN 1200 GR.UNDER WATER(SLOPE ROCKFILL)	m2	8,200.00	16.0340	131,479	9.0250	74,005
10 NP UNWOVEN 800 GR.UNDER WATER(UNDER SCOUR PROT.)	m2	22,300.00	15.8580	353,633	6.6020	147,225
11 11B 513 TRIAL AREA AND CONTROL TESTES	LS			35,652		73,655
12 NP ADDIT. GEOTECHNIC. INVESTIGATION AND LAB. TESTING (Excl. add. invest. areas 1.2,1.5,2.2)	LS			60,527		7,740
13 ~~NP ADDITIONAL CONSULTANCY FEES~~	~~LS~~	Unaccepted		M.L		~~116,[illegible]~~
14 ~~NP LAB.TESTING IN ITA.Y(11000042411E)~~	~~LS~~	Unaccepted		M.L		~~26,115~~
15 10.803 DIAPHRAGM EXCAV. IN SILT,SAND,GRAVEL,COBBLE	m2	23,534.00	20.0558	[illegible]	38.7648	911,503
16 NP E.O. DIAPHRAGM EXCAVATION IN COMP. GRAVEL (450 m)	m2	6,850.00	0.8749	5,993	3.9215	26,862
17 10.804 DIAPHRAGM EXCAVATION IN HARD CLAY	m2	1,330.00	20.9287	27,835	42.6863	56,773
18 NP E.O FOR REVISED CONSTRUCTION METHOD IN SAND (200m)	m2	2,872.00	4.0108	11,520	7.7530	23,042
19 NP E.O. FOR REV. CONST. METHOD IN COMPACTED GRAVEL AND HARD CLAY (200m)	m2	5,378.00	4.1857	22,511	8.5373	45,914
20 NP DRILL HOLES (Provisional)	M.	1,500.00	287.184	430,776	33.213	45,820
21 NP GROUT FILLING (Provisional)	m3	750.00	125.39	94,043	35.723	26,792
22 10.805 DIAPHRAGM PLASTIC CONCRETE	m3	19,853.00	53.7011	1,067,735	14.4363	287,037
23 NP EXTRA OVER EXECUTION (200 m)	m2	6,680.00	10.7402	71,745	2.8573	19,287
24 10.806 DIAPHRAGM CONCRETING UNDER BENT.	m3	19,853.00	3.3892	67,287	7.8434	155,950
25 NP EXTRA OVER EXECUTION (200 m)	m2	6,680.00	0.6778	4,528	1.5687	10,479
TOTAL WORKS				6,445,348	M.L	5,755,970 ~~[illegible]~~
COMPENSATION						
26 ~~TO SPECIALIST SUB SUBCONTRACTOR FOR VIBROFLOTATION - DELETION~~	~~LS~~	Unaccepted		M.L 16/12/91		~~1,705,000~~

CASE 'C'

NEW ESNA BARRAGE CLOSURE DAM - SCHEDULE OF PRICES

SERIS NO.	ITEM DESCRIPTION		QUANTITY	TENDER DESIGN E. P RATE		U RATE	AMOUNT
				RATE	AMOUNT	RATE	AMOUNT
1	9.213 EMBANKMENT FROM STOCK PILES (IN DRY)	m3	160,000.00	0.6305	100,880.00	0.8137	130,192.00
2	9.210 EMPANKEMENT COMPACTION	m3	160,000.00	0.2474	39,584.00	0.2022	32,352.00
3	9.214 EMPANKM. MATERIAL FROM TEMPORARY STOCK PILES	m3	50,000.00	0.5801	29,005.00	0.7115	35,575.00
4	4.2035 EXC. OUTSIDE COFF. PLACED UNDER ELEV. 73.00	m3	270,000.00		0.00		0.00
5	9.217 TRANSTION T2	m3	23,000.00	10.0288	230,662	13.8330	318,159.00
6	9.218 TRANSTION T3	m3	18,000.00	8.0947	145,705	2.0137	36,246.60
7	9.220 RIP RAP [illegible]	m3	20,500.00	7.1470	146,514	2.3533	48,242.65
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	9.225 ROCK FILL DIKE -SCOUR PROTECTION	m3	120,000.00	[illegible]	[illegible]	[illegible]	[illegible]
10	9.1121 UNWOVEN FABRIC FILTER (CREST ROAD)	m2	14,000.00	0.3347	[illegible]	[illegible]	[illegible]
11	9.1122 UNWOVEN 320 GR.	m2	55,000.00	[illegible]	[illegible]	[illegible]	[illegible]
12	11E 911 VIBROFLOT. < 12 m SPACING	m	127,000.00	[illegible]	545,[illegible]	14.2659	1,811,[illegible]
13	11E 912 VIBROFLOT. > 25m	m	0.00	0.0000	0.00	0.0000	0.00
14	11E 914 BACKFILL SAND	m3	10,300.00	0.6761	6,963.83	0.8843	[illegible]
15	11E 915 BACKFILL STONE	m3	2,200.00	2.7917	6,141.74	3.9849	[illegible]
16	11E 919 TRIAL AREA AND CONTROL TESTES	LS			18,951.04		[illegible]
17	10.003 DIAPHRAGM EXCAVATION	m2	23,524.00	20.0538	471,745	38.7648	911,903
18	10.004 DIAPHRAGM EXCAVATION IN HARD CLAY	m2	1,330.00	20.9257	27,835	42.0863	55,975
19	10.005 DIAPHRAGM PLASTIC CONCRETE	m3	19,883.00	53.7011	1,067,739	14.4363	287,037
20	10.006 DIAPHRAGM CONCRETING UNDER BENT.	m3	19,883.00	3.3892	67,387	7.8434	155,950.32
	TOTAL OF CONTRACT DESIGN				6,448,157.2		4,545,179.2

(C:\Q\TENDER3.WK[illegible])

Dr. Abdel-Fattah Abouleid
Consulting Engineer

دكتور عبدالفتاح السيد أبوالعيد
مهندس استشارى

Our Ref. :
Date :

خطابنا رقم : ٦٨٤٣ (٧٦/١٤٨٧ ـ ٨٩)
التاريخ : ١٩٩٢/١/٢٠

مرفق رقم (٧)

الموضوع : مشروع قناطر أسنا الجديدة
السد الدائم

السيد المهندس الاستشارى / رئيس مجلس الادارة
المكتب الاستشارى للتصميمات الهندسية ومشروعات الرى (اديبكو)

نهدى اليكم أطيب تحياتنا وبعد ،

ايماءا الى خطابيكم بتاريخ ١٩٩١/١٢/١٨ ، ١٩٩٢/١/١٤ والخاص بالمكاتبات المتبادله بين المكتب والمقاول بخصوص الاقتراح المقدم لتنفيذ السد الدائم ، بالرجوع الى محضر الاجتماع الذى تم بمكتبنا بتاريخ ١٩٩١/١١/٤ والى تعقيب مكتب سوجرييه على هذا المحضر . نفيد سيادتكم بما يلى :

١ ـ أن الاختبارات الاخيره التى تمت على نوعيه الرمل المتوافر بالموقع لتنفيذ السد الدائم طبقا للحل الاصلى الوارد بالعقد تبين صعوبه الوصول الى درجة دمك مقبوله تفى بالاشتراطات وذلك نتيجه وجود نسبه عاليه من المواد الناعمه فى كثير من العينات والتى اثبتت الدراسات السابقه انها توثر سلبيا على كفاءة الدمك المتوقعه .

٢ ـ أن استخدام طريقة الدمك المعروفه باسم Vibro flotation لاتعطى درجه ثقة موكده مع مثل هذه النوعية من الرمل المتوافر بالموقع .

٣ ـ أن الوصول الى كفاءة تامه لعمليه الدمك يتطلب رمل نظيف يكاد يكون خاليا من المواد الناعمه وهو مالايمكن تأكيده طبقا لبيانات الرمل الموجود بالموقع بل على العكس قد يودى استخدام هذا الرمل الى كثير من المصاعب وعدم التأكد من الوصول للنتيجه المرجوه . هذا فضلا عن التأخير وضياع الوقت

بعده / ...

دكتور عبدالفتاح السيد أبوالعيد
مهندس استشاري

Dr. Abdel-Fattah Abouleid
Consulting Engineer

خطابنا رقم : ٦٨٤٣ (٧٦/١٤٨٧ ـ ٨٩)
التاريخ : ١٩٩٢/١/٢٠

Our Ref. :
Date :

فى تجربه جزء من السد وتقييم الموقف وطريقه العلاج فى حينها حسب النتائج التى يصعب توقعها من الان .

٤ ـ أن عملية تقييم كفاءة الدمك الحقلية فى حالة استخدام طريقة Vibro flotation غير دقيقه وقد تعطى نتائج غير موثوق بها . وقد اقر استشارى سوجريه بهذا وأورد امثله من مشروعات سابقه لم تعطى فيها نتائج الاختبارات الحقليه لتقييم كفاءة الدمك نتائج متوافقة كما هو مذكور فى محضر الاجتماع الذى تم فى مكتبنا بتاريخ ١٩٩١/١١/٤ .

٥ ـ أن الحل المرادف الذى تقدم به المقاول مقبول من الناحية الفنية ويلغى جميع المشاكل التى قد تظهر من استخدام نوعيه الرمال الموجوده بالموقع كما سبق ايضاحه . وقد أوضح استشارى سوجريه موافقته على هذا الحل المرادف من الناحية الفنية كما هو ثابت من محضر الاجتماع الذى تم فى مكتبنا بتاريخ ١٩٩١/١١/٤ .

مما سبق يتبين أن الحل المرادف الذى تقدم به المقاول يعتبر أفضل من الناحيه الفنيه ويحقق درجه أعلى من الامان وسرعة التنفيذ بدون مصاعب .

والله ولى التوفيق ..

المهندس الاستشارى

دكتور / عبد الفتاح السيد أبو العيد

EUROCEB

EUROPEAN CONSORTIUM FOR ESNA BARRAGE

Impresit - Girola - Lodigiani	Gruppo Industrie Elettromeccaniche per
"IMPREGILO" S.P.A.	Impianti all'Estero - G.I.E-S.P.A.
COGEFAR Costruzioni Generali S.P.A	ROMENERGO State Enterprise for Foreign Trade

Grouting

Date : 26/07/92, Esna
Ref. : ED/E/404/92

To : Edipco
Esna

Subject : Civil Works, Closure Dam, Method Statement for Grouting.

Dear Sirs,

Please find attached method statement for the grouting works which are to be carried out prior to construction of the central portion of the Closure Dam.

We now propose to use our Sub-contractor Rodio on these works instead of a local Sub-contractor as previously indicated.

We would be pleased to receive your approval of the foregoing.

Received
27-7-92

Yours faithfully

EUROCEB
European Consortium For Esna Barrage

Eng. PIER LUIGI CALDANI
Project Manager

Encl. as above

Edipco Esna	3 copies
Edipco Cairo	1 copy
MPW & WR Esna	2 copies
MPW & WR Cairo	1 copy

NEW ESNA BARRAGE AND POWER PROJECT

CLOSURE DAM

GROUTING - METHOD STATEMENT

1. General

This activity will be performed from the embankment fill at an elevation varying from 74 m. to 75 m. (generally keeping 1m. above the river water level) and starting from the Right Bank going toward the concrete structures.

The sub activities will be performed according to the following sequence:

a. penetrate the fill material of the Closure dam by means of a E-driven vibrator (Vibropoker - 50 KW/50Hz - dia.290 mm. - equipped with flushing/grouting pipes) with the aid of water flushing.

b. before reaching the proposed final depth of the hole, the flushing water supply to the tip of the vibropoker will be stopped and the vibrator will be sunk up to the final depth into the soil (fill) without water flushing. Upon reaching the proposed depth, the pumping of grout mixes through the grout/flushing pipes of the vibrator, including monitoring of the grout takes, will be started and the vibrator gradually withdrawn from the hole.

2. Drilling with continuous casing

The forming of the holes, in accordance with the basic pattern as described in the ELC report ESN-D-8708 page 7-4, will be achieved by means of a vibrating unit, having an approx. outside diameter of 290 mm., from the working platform elevation down to approximately 2m. below the contact between the Nile river bed and the embankment fill. Owing to the definition of the area to be treated, it is anticipated that the hole depth would vary from 10 to 14 m., thus an average depth of 12 m. has been assumed for the estimation of the total quantity. The vibrator (Keller type MW - 50 KW/50Mz) will be handled by a crawler mounted crane type Link Belt LS108 or similar.

The vibrator will be provided with extension pipes having a total length of 16 m. approximately and equipped with extending grout pipes in order to allow the connection of the vibrator itself with the grouting pump.

Once the final depth has been reached, or even before, the water flushing will be stopped and the grouting operation will proceed while the vibrator will be gradually extracted from the fill applying short and intermittent vibration periods.

The vibrating unit will then be moved to the next hole of the downstream row and the operation will be resumed applying the same technique as described above.

The vibro grouting will proceed alternating one primary hole upstream with one primary hole downstream and viceversa.

3. Grouting

As indicated by the drilling activity description, the grouting activity shall start simultaneously with the vibrator extraction. The grouting pump to be used will be of screw feed type, having a high discharge capacity and a low discharge pressure, it is therefore anticipated to utilize a grout pump type Moro 1200 or similar. The grouting operations will be performed connecting the grout pump to the vibrator through a 2" flexible heavy duty grout hose, having a sufficient length in order to allow the continuous extraction of the vibrator without interruption.

The grout mix to be injected will be similar to that used for the temporary diaphragm wall construction, i.e. the approximate composition per cubic meter of mix would be:

Water	931 liters
Bentonite	37 kg.
Cement	180 kg.

Owing to the nature and scope of the treatment, it is not anticipated to proceed with a strict quality control of the grout mix properties. Therefore, a very simplified quality control will be implemented just by checking the viscosity and the specific gravity of the mix in the vicinity of the grout pumps. The characteristics of the grout mix shall be of the order of 1,167 kg/cm. as specific gravity and a viscosity ranging from 42 to 60 seconds Marsh.

The basic parameters guiding the grouting operations would be the grout takes versus the pressure and the speed of extraction of the vibrator.

Owing to the lack of realistic parameters that might be defined by field test results, the following parameters are estimated and will be adjusted as necessary in accordance with conditions on site.

a. average pump discharge 300 l/min. (from 500 to 1000 l/min).
b. minimum pumping pressure (at the pump) 2 Bar.
c. average speed of extraction of the vibrator approx. 3 min/m.

After having performed the first 50 m. (measured along the longitudinal axis of the treatment) of the basic pattern of the treatment, it is proposed to move the equipment back to the first two holes performed upstream and check if additional holes are needed. This test will be performed just by driving an intermediate secondary hole, between the two upstream primary holes (thus reducing the hole spacing to 1.5 m.) and checking the grout takes. If the grout takes of the few initially driven secondary holes, grouted respecting the same grouting parameters applied for the primary grouting treatment, will show the same order of magnitude of the primary treatment, it is recommended to densify all the grouting treatment, driving and grouting systematically the secondary holes.

4. List of Main Equipment

In order to perform the sub-activities described in the foregoing, the following main equipment will be provided:

- 1 Crane Crawler mounted type LS 108 (or similar) with boom 28 m. long.

- 1 Vibrator type KELLER MW - 50 KW/50HZ with extension pipes, water/grout swivel, having an outside diameter of 290 mm.

- 1 Batching plant for the preparation of the grout mix having a capacity of 20 cum./hr. (type RODIO IM 20 or similar).

- 2 Holding tank/agitator having a capacity of 3 cum.

- 1 - 2 Screw feed grout pump type MORO 1200 or similar equipped with suitable length 2" heavy duty grout hose.

- Grout pressure gauge and chronometer to be assembled into the crane operator cabin.

- All ancillary and fittings necessary to perform the activities described in the foregoing.

Impregilo-Cogefar J.V.

23.07.92


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